Trouble-shooting instructions : LAI-5000

BOSCH system : VE..F.. pump

Vehicle make : LANCIA

Basic microcard : FIA-500

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SPECIAL FEATURES

These trouble-shooting instructions apply to the following vehicle models current at the time of writing:

* LANCIA Prisma Diesel (6.84 ->)
  Engine 831.D.000 (1.9 l / 48 kW)

* LANCIA Prisma Turbo-Diesel (5.85 ->)
  Engine 831.D1.000 (1.9 l / 59 kW)

Please note:

Even when referring to basic instructions, the nominal values, terminal assignments, and special features of these vehicle-specific brief instructions are always binding.

* Checking charge-air pressure

When working on the turbo-supercharger, note that even the smallest particles of contamination can lead to the destruction of the supercharger. For this reason, the engine should never be operated without an air filter. Pressure-measuring device KDJE P 100 or a 0...1.6 bar pressure gauge (e.g. Wika no. 4184) can be used to test charge-air pressure.

The charge-air pressure should be measured under full load, on a chassis dynomometer wherever possible. At 2400 min^{-1}, the charge-air pressure is 0.8 bar.

Note:

Evaluation of the condition of an exhaust turbo-supercharger requires that start of delivery and nozzle-opening pressure are correctly set, that the induction and exhaust sides show no leakage, and that the engine is in good mechanical condition (valve clearance, compression).
If the charge-air-pressure control valve is defective, replace the exhaust turbo-supercharger. After installing a new exhaust turbo-supercharger, fill the supercharger with oil and let the engine run about 1 minute in idle, in order to guarantee oil supply to the supercharger.

For production reasons: continued on the following coordinate.

TEST SPECIFICATIONS

* Idle speed:	740...800 min $^{-1}$
* Nozzle-opening pressure:	150 + 8 bar (engine 831.D1.000) 130 + 8 bar (engine 831.D.000)
* Charge-air pressure:	0,8 bar
* Compression:	21 $\pm$ 0,5 bar

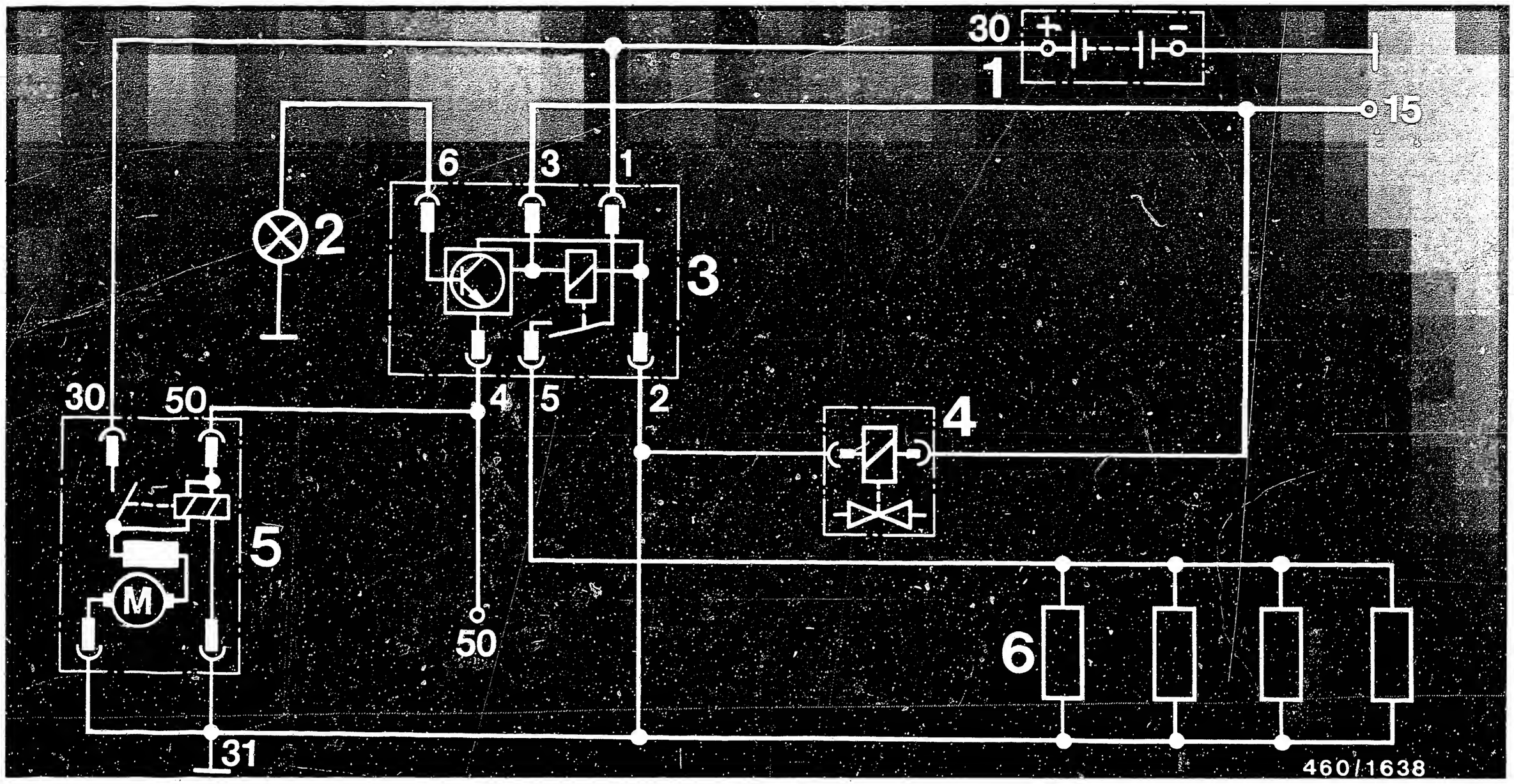
* Pump-engine coordination

Engine position:	1rst cylinder at TDC
Setting value (static)	
Pump position:	1 mm after BDC

Test specifications (continued)

Tightening torques:

* Sheathed-element glow plugs	15 Nm
* Nozzle- and-holder assembly	78 Nm
* Fuel-injection pump gear (hex nut)	49 Nm
* Fuel lines (union nut)	25 Nm
* Fastening nuts and bolts for fuel-injection pump	23 Nm
* Toothed-belt tensioning roller (hex nut)	44 Nm



1 = Battery
2 = Preheating indicator lamp
3 = Glow-duration unit
4 = Solenoid-operated valve
5 = Starting motor
6 = Glow plugs

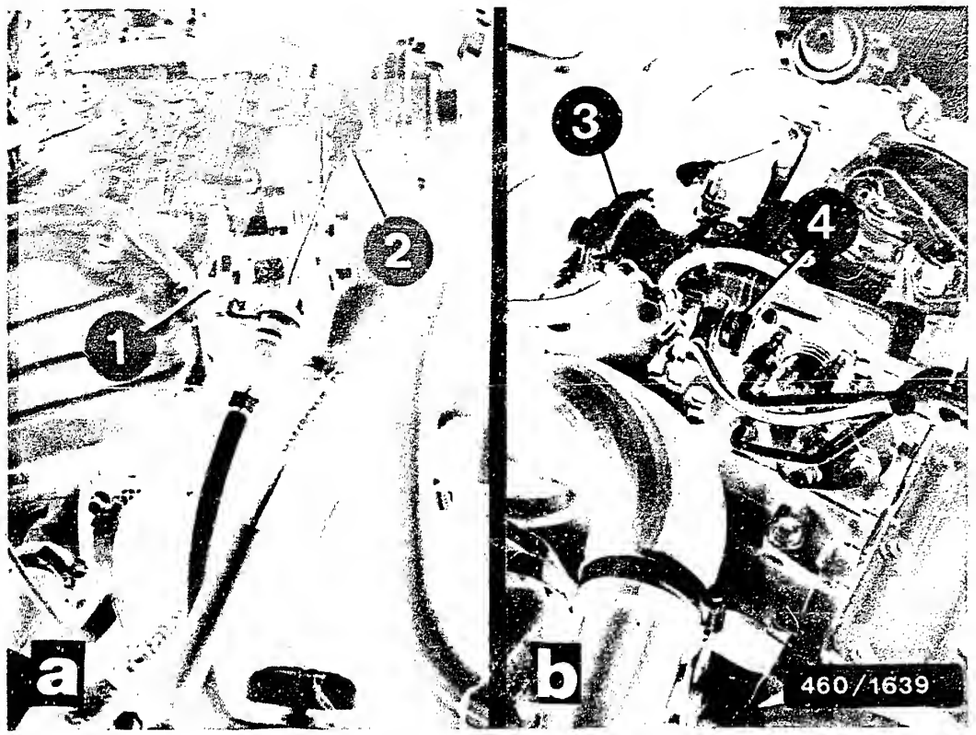
PREHEATING SYSTEM TERMINAL DIAGRAM

TEST EQUIPMENT AND TOOLS

Description	Part number	Application
Box wrench	KDEP 1115	Loosening/ tightening fuel-injection tubing
Measuring device	KDEP 1085	Coordinating pump and engine
Small dial indicator 1/100 mm graduation	1 687 233 011	Coordinating pump and engine
Pressure-measuring device or Pressure gauge 0...1.6 bar	KDJE-P 100 e.g. Wika no. 4 184	Testing charge-air pressure
Puller	KDEP 1118	Pulling off toothed-belt gear
Tensioning tool (*)	FIAT part no. 1 860 745 100 or 1 860 745 200	Adjusting toothed-belt tension
Threaded pin (*)	FIAT part no. 1 860 473 000	Locking the camshaft-drive belt gear

(*) Obtain tools from local FIAT dealer.

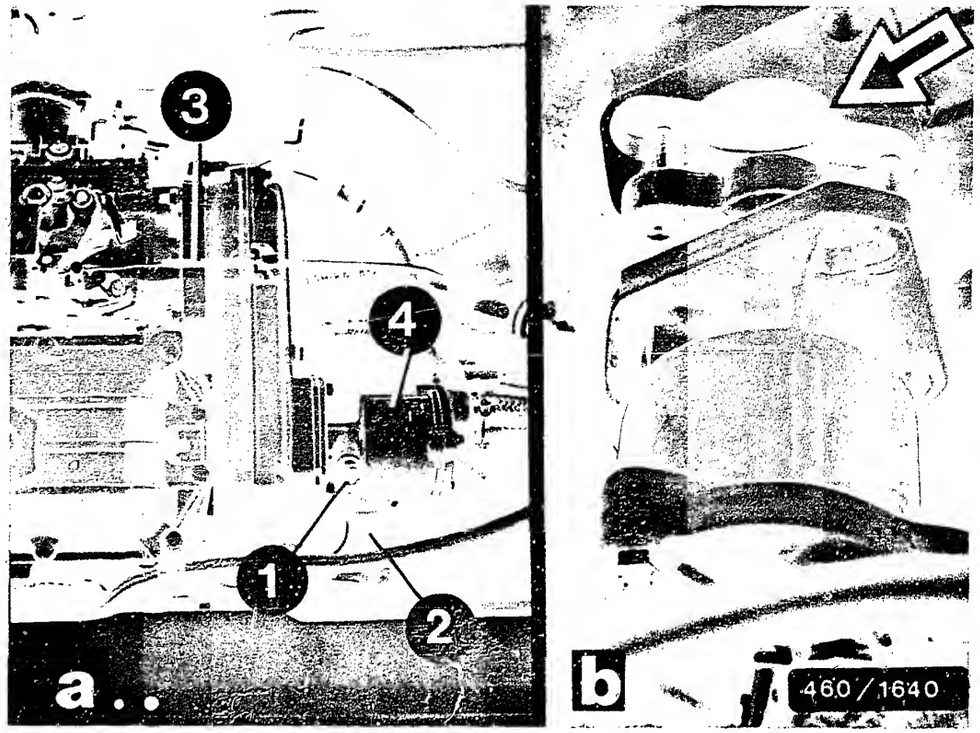
For production reasons: continued on the following coordinate.



1 = Fuel supply line
2 = Bowden cable (accelerator pedal)
3 = Manifold-pressure compensator (LDA)
4 = Electric shutoff (ELAB)

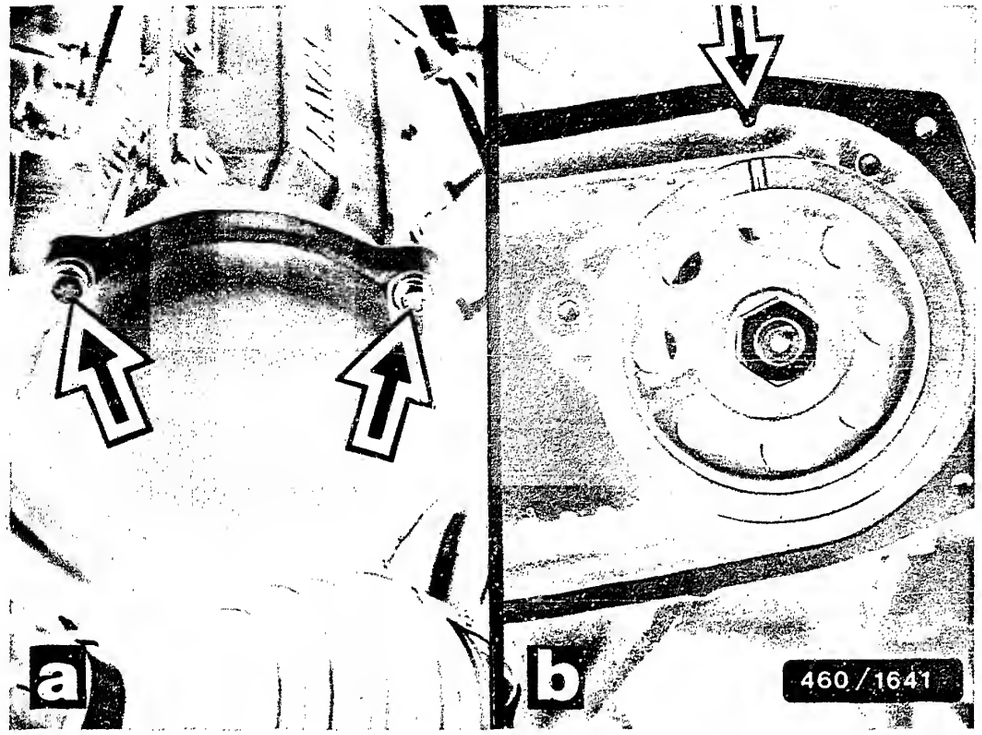
REMOVING FUEL-INJECTION PUMP

Disconnect the negative cable from the battery. Remove the bowden cable (accelerator pedal) and fuel supply line (Fig. a). Remove the electrical connection cable (ELAB), pressure line (LDA), and fuel-injection tubing (Fig. b).



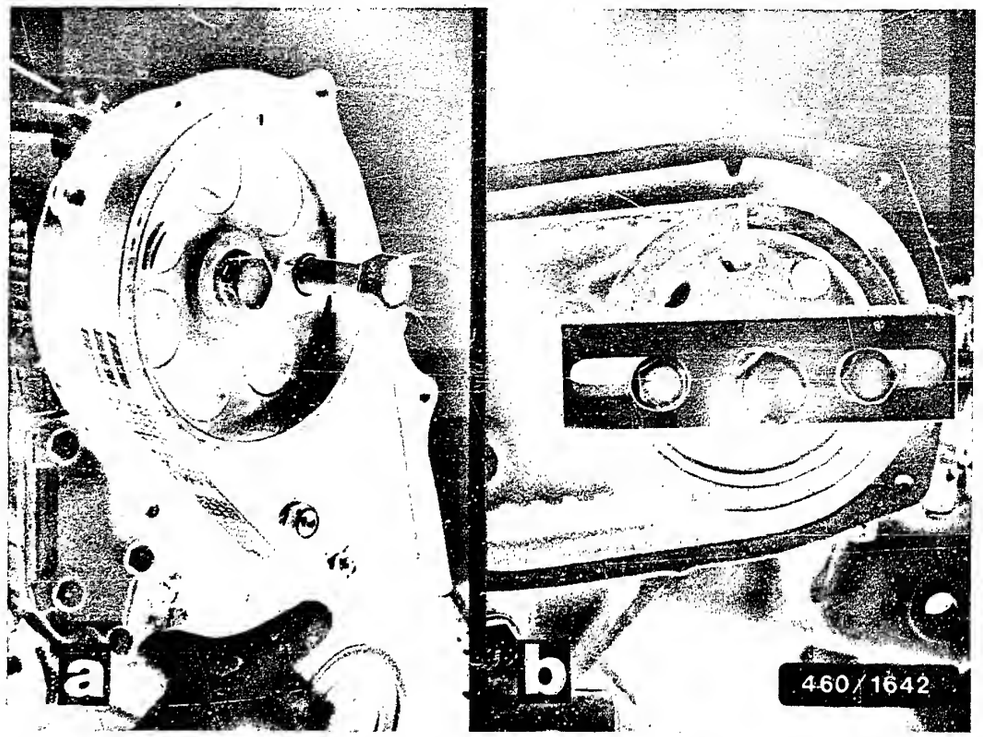
1 = Inlet-union screw
2 = Oil return line
3 = Bowden cable (KSB)
4 = Vacuum pump

Remove inlet-union screw.
Loosen hose clamp and pull off oil return hose.
Disengage bowden cable (KSB) (Fig. a).
Remove the 2 vacuum-pump fastening bolts.
Turn the engine until the vacuum pump can be pulled out of the opening in the cover (arrow).
Remove the 6 fastening screws from the cover and remove cover (Fig. b).



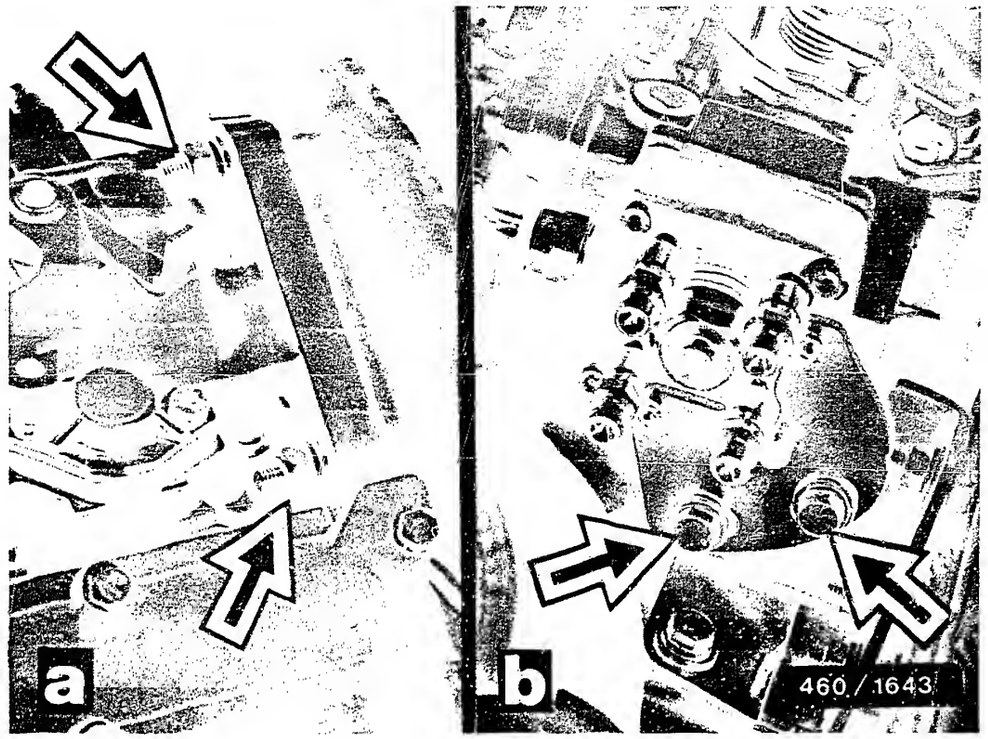
Remove the 4 fastening screws from the camshaft-drive toothed-belt protection cover (Fig. a).

Align adjusting marks (Fig. b).

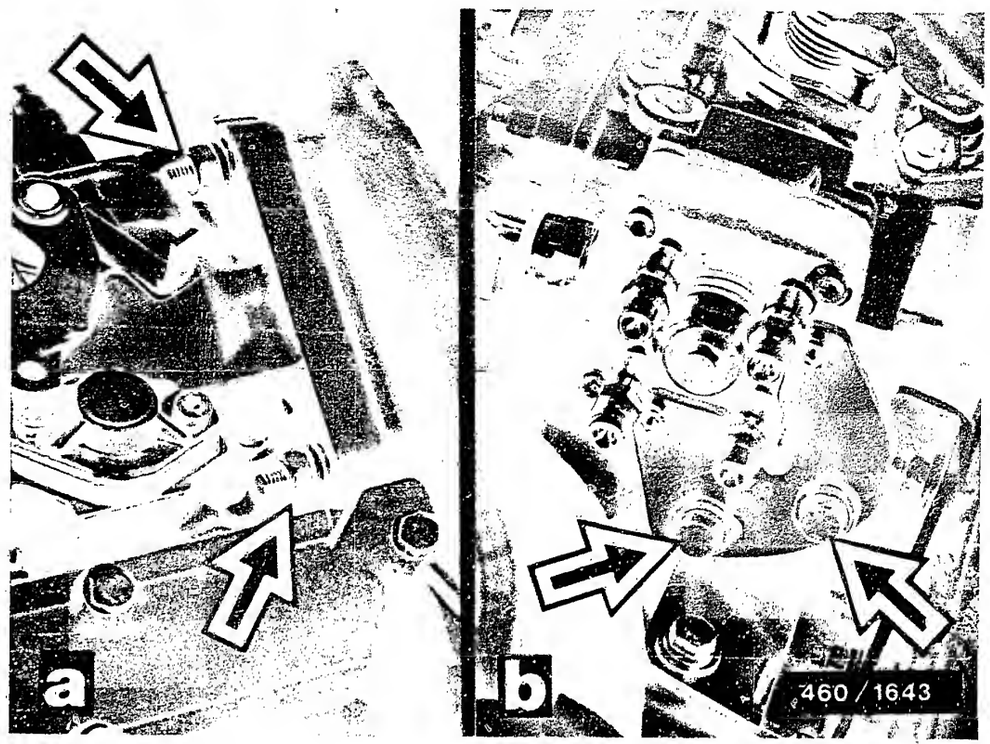


Lock the belt gear on the camshaft using Fiat tool 1 860 473 000 (Fig. a).

Remove nut.
Position tool KDEP 1118 and pull the belt gear from the fuel-injection pump shaft end (Fig. b).



Remove the 3 fastening nuts on the fuel-injection pump flange (Fig. a – arrows) and fastening screws of supporting plate (Fig. b – arrows).



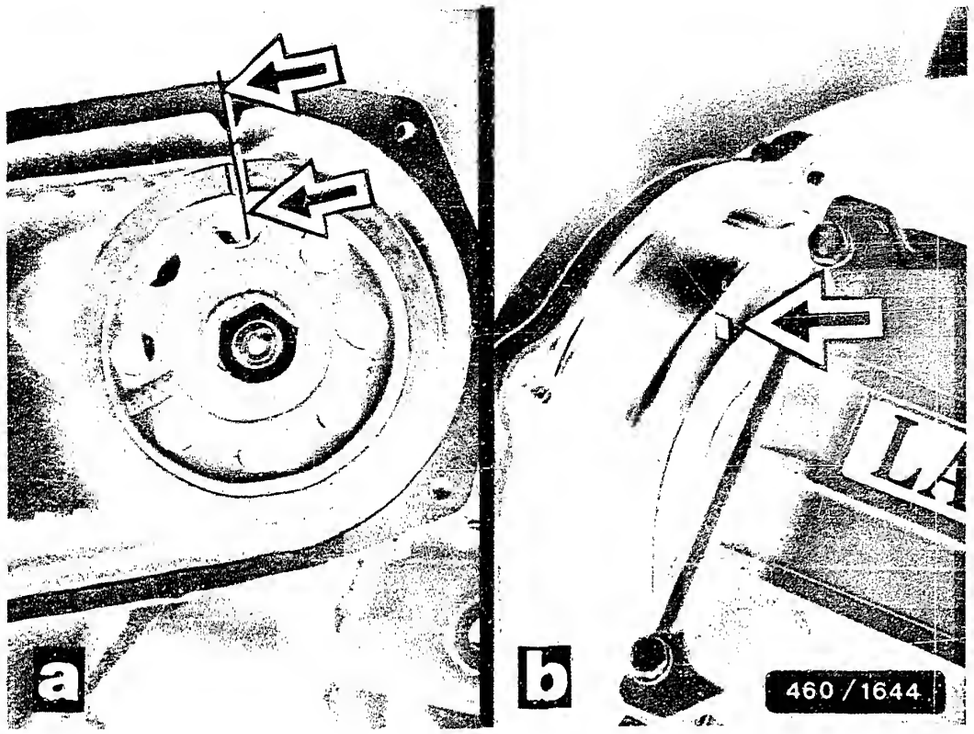
INSTALLING FUEL-INJECTION PUMP

Insert fuel-injection pump into housing.

The stay bolts are in the middle of the slots in the fuel-injection pump flange.

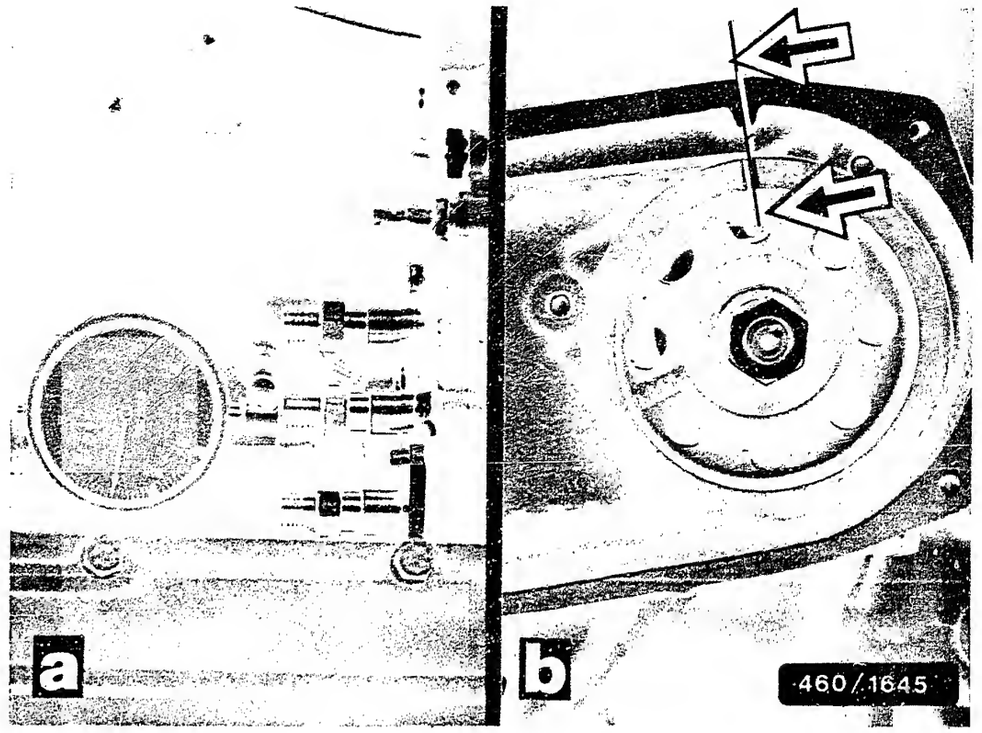
Loosely tighten 3 nuts (Fig. a – arrows).

Loosely tighten the fastening screws for the support plate (Fig. b – arrows).



Place the belt gear on the fuel-injection pump shaft end.
Tighten the nuts by hand.
Loosen the nuts by 2 turns. Pull belt gear away against the nuts. Put on the toothed belt. Bring the adjusting marks into alignment (Fig. a). Do not damage spring!

Check adjustment (marks on Fig. a and Fig b must be in alignment).
Tighten nuts to 49 Nm.
Remove threaded pin (Fiat part no. 1 860 473 000).



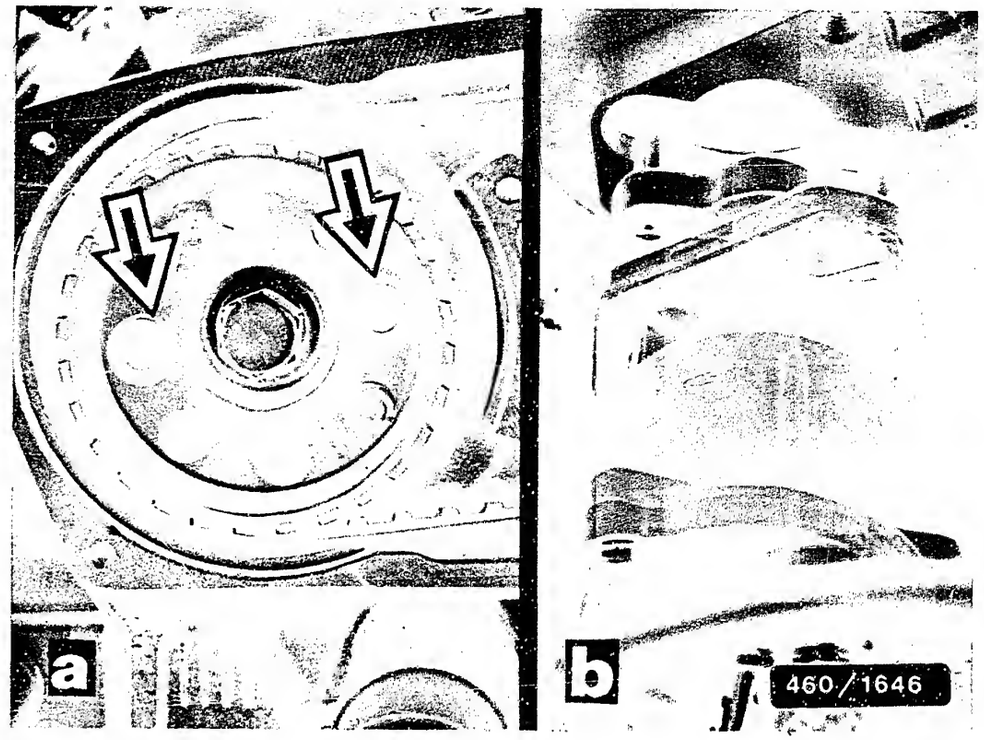
Remove the bleeder screw. Mount measuring device KDEP 1085 (Fig. a).
Turn engine against its direction of rotation until the dial indicator indicates BDC of the pump piston.
Set dial indicator to zero.
Turn the engine in its direction of rotation until the setting marks are aligned (Fig. b).
The dial indicator must show a value of 1 mm.
If not, correct by slewing the fuel-injection pump.

Note:
Poor tension on the part of the toothed belt for camshaft drive impairs pump adjustment.

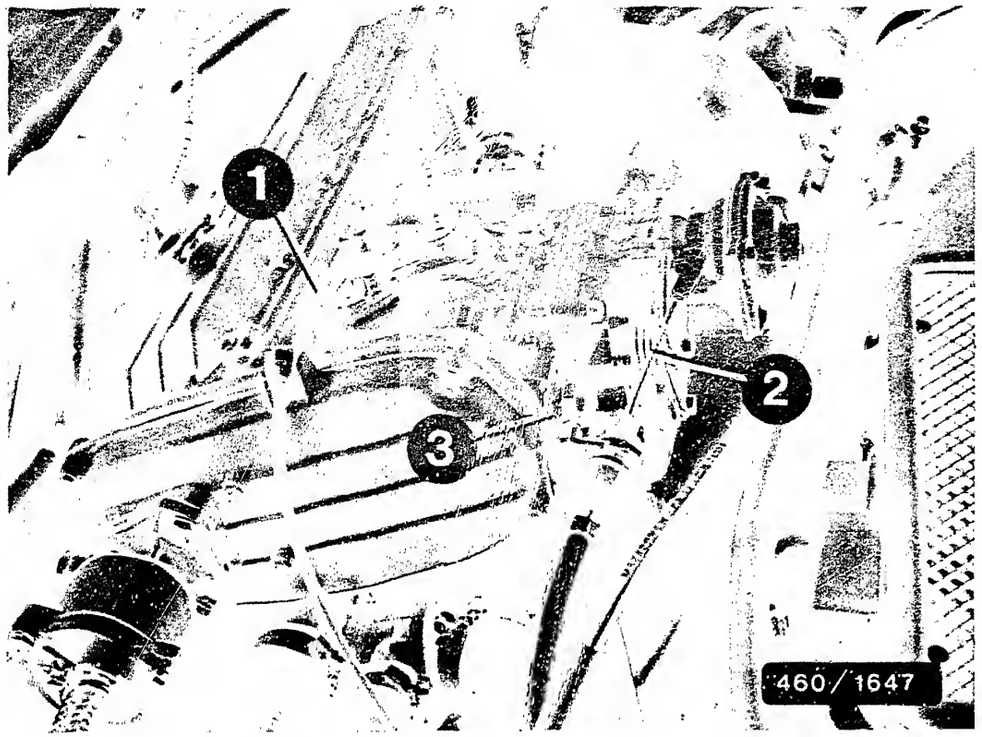
* Testing setting:

Turn the crankshaft 1 3/4 turns in direction of rotation.
Check whether dial indicator is to "0" in BDC position of pump piston.
Turn crankshaft further until TDC position (engine) is reached. The dial indicator on the
fuel-injection pump must show a piston stroke of 1 mm.
Tighten fastening nuts to 23 Nm. Remove measuring device KDEP 1085 and screw in bleeder plug with new copper seal ring.
Tighten the fastening screws on the support plate to 23 Nm.
Mount the camshaft-drive toothed-belt protection cover.

Zeilenanzahl * 1 * Unterschied!!



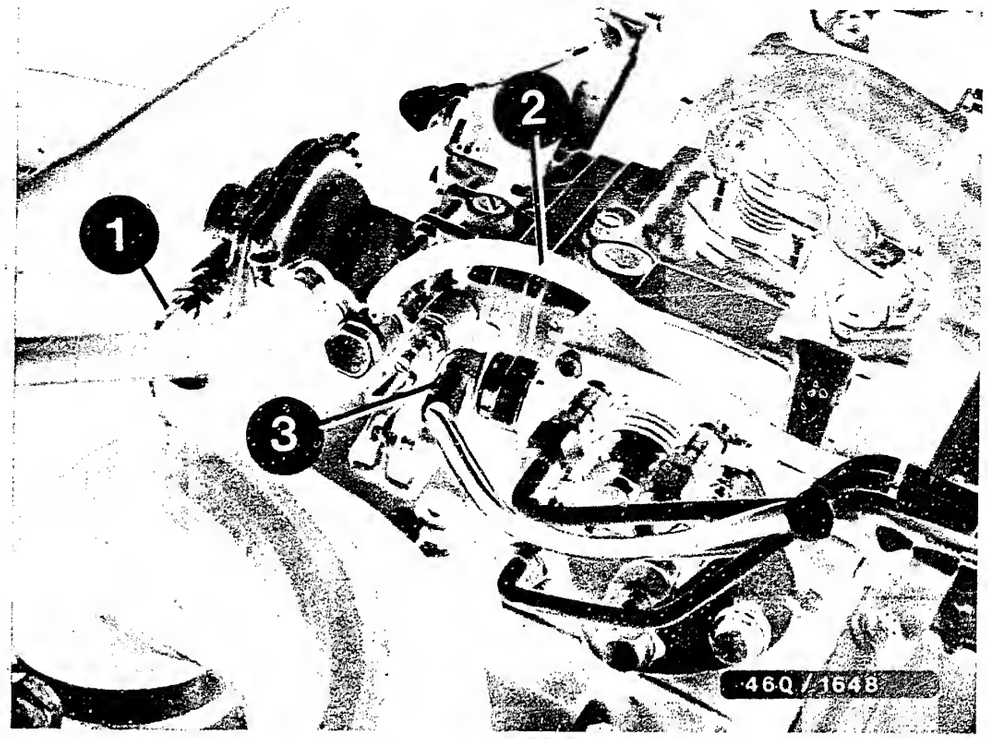
Install the fuel-injection pump drive housing cover.
Turn the engine in its direction of rotation until both damping elements of the belt pulley are visible in the cover opening (arrows).
Insert and tighten vacuum pump.
Mount the oil return hose, lubricating oil supply line with union nut (use new copper seals).



1 = Bowden cable (KSB)
2 = Bowden cable (accelerator pedal)
3 = Fuel supply line

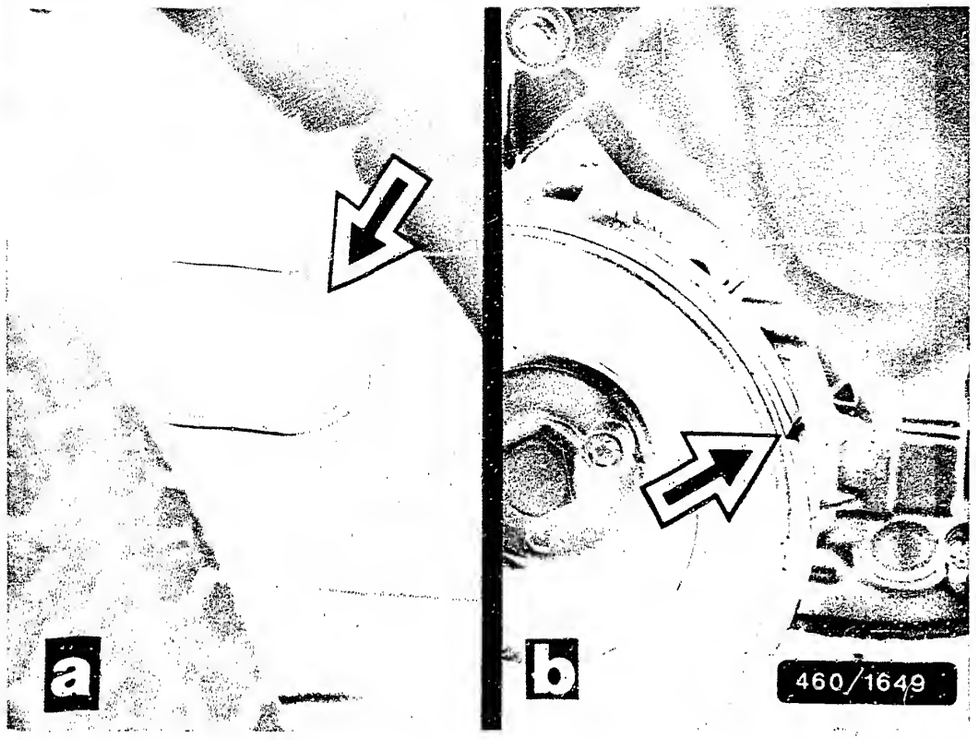
Install fuel supply line (use new copper seals).

Install bowden cables for KSB and accelerator pedal.



1 = Pressure line (LDA)
2 = Fuel return lines
3 = Electrical connection cable (ELAB)

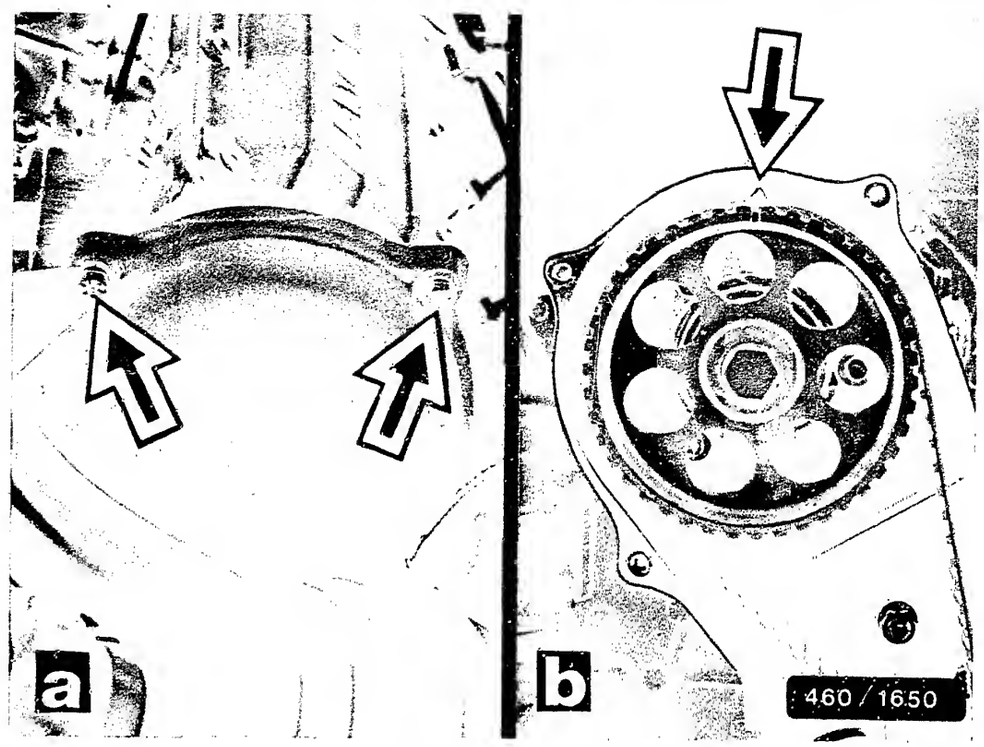
Connect pressure line (LDA) and connecting cable (ELAB).
Install fuel return lines (use new copper seal rings); the inlet-union screw is marked "OUT".
Install fuel-injection tubing.



TESTING AND ADJUSTING ENGINE TIMING

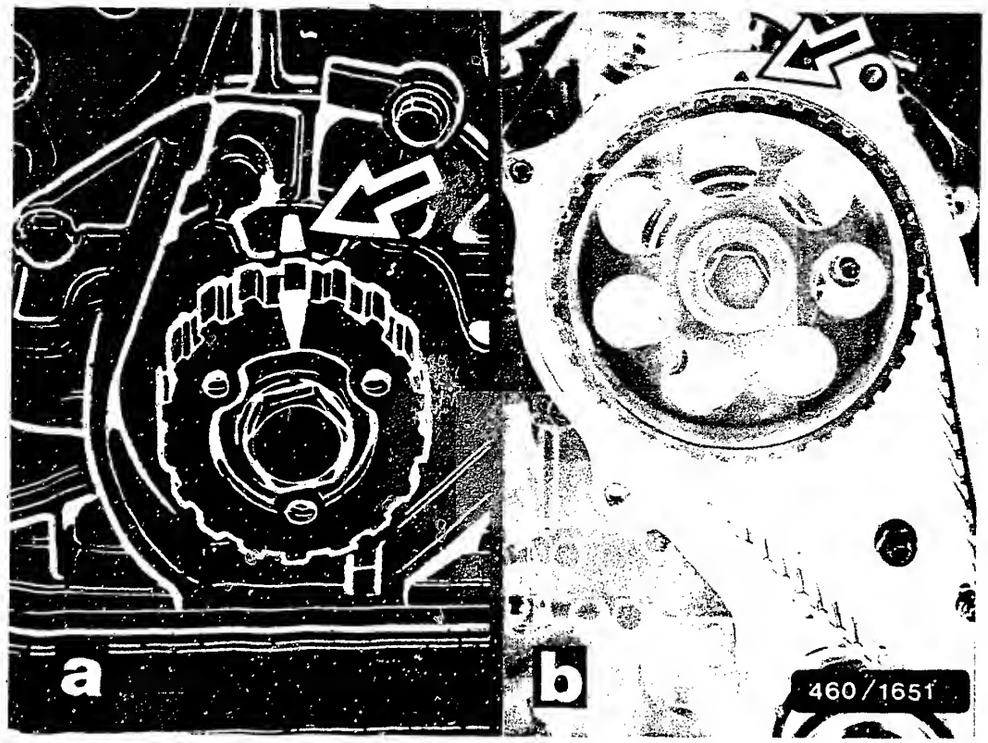
Put car in gear.
Raise car and remove right front wheel.
Take away the cover (Fig. a – arrow) in the wheel well.

Bring the markings on the belt pulley and cover of the camshaft drive into alignment (Fig. b – arrow).



Remove the 4 fastening screws from the camshaft-housing cover (Fig. a).

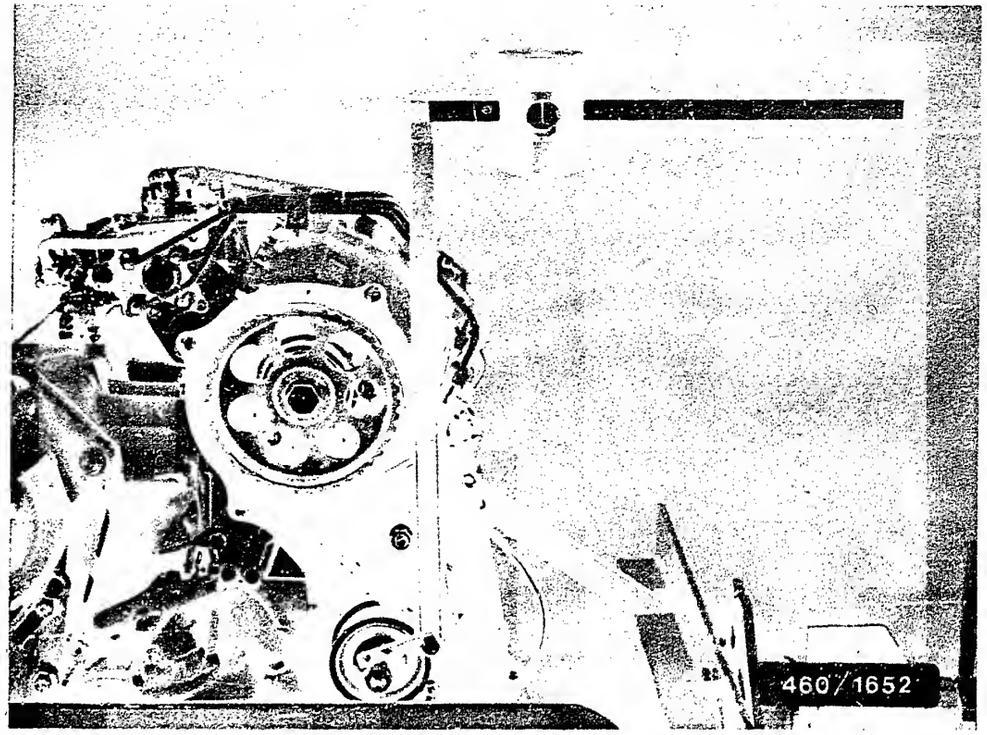
The line on the belt pulley must be in alignment with the hole marking on the camshaft housing (Fig. b).



Adjusting engine timing

Remove the cylinder-head cover. Bring crankshaft into TDC of 1rst cylinder by turning right front wheel (4th cylinder is then at valve overlap). Remove the V-belt and belt pulley. Loosen the tensioning roller and remove the toothed belt.

Align the marks on the belt gear and bearing end plate (Fig. a – arrow) and marks on the belt gear and camshaft housing (Fig. b – arrow).



Put on the toothed belt.
Place FIAT tool 1 860 745 100 or 1 860 745 200 on the tensioning device.
Set weight to value of 65 mm.
Turn the engine two revolutions in direction of rotation. The adjusting marks must be in alignment. Tighten tensioning-device nuts to 44 Nm.
Mount the belt pulley and V-belt, and tension.
Replace the cylinder-head cover and cover of camshaft drive.

Check the coordination of the pump and engine.
Setting value: pump position 1 mm after BDC.

Trouble-shooting instr.: BMW-5003

BOSCH system : Motronic

Vehicle make : BMW

Basic microcard : BMW-509

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SPECIAL FEATURES

These trouble-shooting instructions apply to the following vehicle models current at the time of writing:

* BMW M 635 CSi (05.84 -> 08.86)

* BMW M 5 (01.85 -> 08.86)

  Both with 3.5 l / 6-cyl./ 4-valve engine

- Countries of use: Germany

- Same control unit (no. 0 261 200 055) in M 745i with computer-aided transmission shift (South Africa version only).

- 6 individual throttle valves, but only one idle-speed-adjusting screw (and one throttle-valve switch)

- Use diagnostic cable 1 684 463 122 for measurement of spark advance.

* Construction, use:

These brief instructions essentially comprise vehicle-specific special features and test specifications (nominal values).

The trouble-shooting chart leads to various causes/component faults, depending on the customer complaint.
Detailed information for trouble-shooting can be found in the trouble-shooting chart of the basic instructions.

NOTE: Even when referring to the basic instructions, the nominal values, terminal assignments, and special features of <u>these</u> vehicle-specific brief instructions are <u>always</u> binding.

Identical test-step numbering facilitates the locating of individual test steps in the brief and basic instructions.

* Safety and preventative measures:

Do not expose persons to hazards.
Prevent damage to the engine, control unit, and ignition system.

C A R E F U L !
High-power ignition system.
Hazardous high and low voltages.

Do not touch voltage-carrying parts or terminals, as this can be fatal, on both the primary or secondary sides.

Make sure that fuel-injection does not take place during compression testing.
To ensure this, disconnect the pump relay.

For further safety measures, see the basic instructions.

* Additional test equipment and tools

Description	Designation	Part no.
Motortester	e.g. MOT 200 or MOT 201 or MOT 300 or MOT 400	0 684 000 200 0 684 000 201 0 684 000 300 0 684 000 400
Diagnostic cable for measuring spark advance		1 684 463 122
Multimeter (Internal resistance at least 20 k Ω /V)		Commercially available, e.g. Metrawatt GmbH Type MA2H or Fluke Multitimer 75 or 77

TROUBLE-SHOOTING CHART

Customer complaint (system of trouble)

1. Starting motor operates, engine fails to start or starts only with difficulty.	2. Engine starts but then dies.	3. Idling problems (engine speed, exhaust).	4. Poor throttle response.	5. Engine missing (ignition, fuel injection).	6. No maximum engine power/ top speed.	7. Excessive fuel consumption.	8. Engine cannot be cut off with ign. key.	9. Engine pinging/knocking.	10. Engine heats up excessively.	11. Warning lamp.	Cause (component fault)
*	*	*	*	*	*	*		*	*		Universal test adapter
	*	*									Auxiliary-air device
*	*	*	*	*	*	*		*	*		Air-flow sensor
*	*	*	*		*						Induction system
*		*			*	*					Sol.-oper. fuel-injection valves
					*						Fuel pressure
				*	*						Fuel quantity
					*						Throttle valve
				*							Poor ground connection
*	*	*	*	*	*						Open circuit in leads
*	*	*									Start valve
*	*										Thermo-time switch
		*				*					CO-exhaust setting
				*							Alternator, interference suppr.
*		*	*	*	*	*					Secondary patterns

For production reasons:
continued on the following coordinate.

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01

Adapter lead: 1 684 463 124
Valid for control unit 0 261 200 055

Test step	Switch V	Switch Ω	Terminals	Testing of component/ function	Test instructions/ Test conditions	Set values
1	V	1	8 <=> 5	Insulation resistance engine-speed sensor	Shift into neutral, switch off ignition and disconnect Motronic control unit and pump relay. For M 745 i (electronic transmission control), likewise disconnect transmission control unit.	Greater than 1 M Ω
2	V	2	25<=> 5	Insulation resistance reference-mark sensor		Greater than 1 M Ω
3	V	3	8 <=>27	Winding resistance engine-speed sensor		0,6...1,6 k Ω
4	V	4	25<=>26	Winding resistance reference-mark sensor		0,6...1,6 k Ω
5	V	5	13<=> 5	Resistance, temperature sensor (coolant)	At + 15°C...+ 30° C	1,45...3,3 k Ω
6	V	6	22<=> 5	Resistance, temperature sensor (intake air)	At + 15°C...+ 30°C	1,45...3,3 k Ω
7	V	7	10<=> 5		Not applicable Note: for M 745 i (electronic transmission control), term. 10 connected to transmission control unit term. 24 (engine action or spark-advance intervention)	
8	V	8	29<=> 5		Not applicable	
9	V	9	2<=> 5	Resistance idle contact	Do not actuate accelerator pedal: Actuate accelerator pedal (part load range):	Smaller than 10 Ω Greater than 1 M Ω
10	V	10	3<=> 5	Resistance full-load contact	Push accelerator pedal to floor (full-load stop): Slowly release accelerator pedal: Note: for M 745 i (electronic transmission control), observe test step.	Smaller than 10 Ω Greater than 1 M Ω

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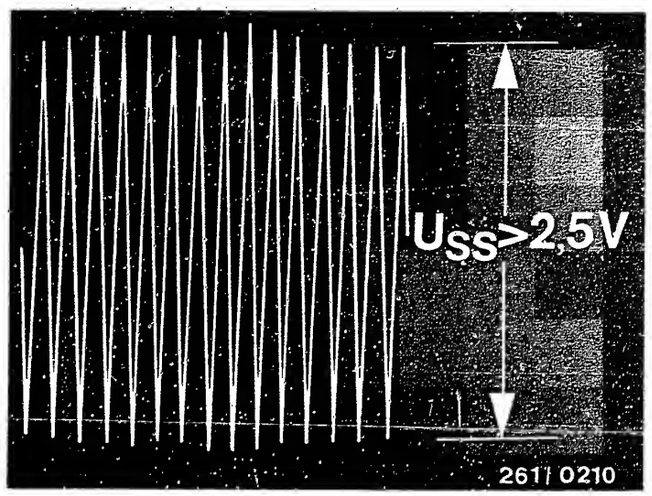
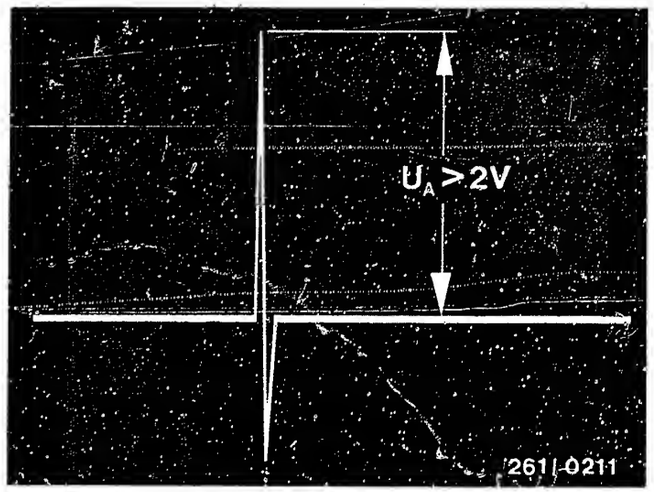
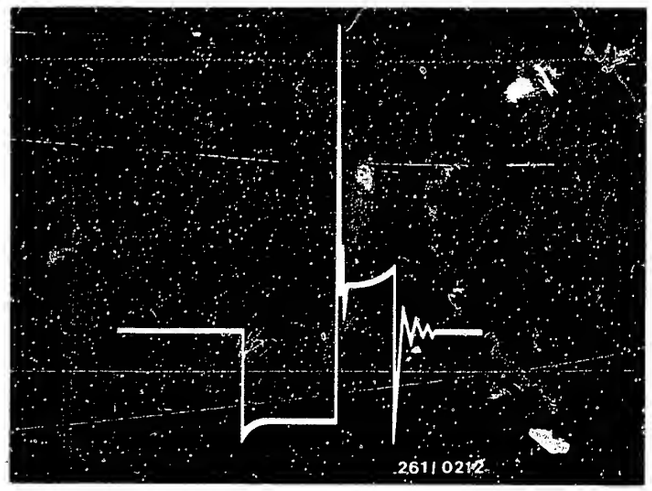
Rapid diagnosis chart for universal test adapter ETT 018.01 (continued)
Adapter cable: 1 684 463 124 / valid for control unit 0 261 200 055

Test step	Switch V	Switch Ω	Terminals	Test of component/function Testing instructions/conditions	Nominal values
11	V	11	16<=> 5	1st fuel-injection output stage ground	less than 10 Ω
12	V	12	17<=> 5	2nd fuel-injection output stage ground	less than 10 Ω
13	V	13	19<=> 5	Ignition output stage ground	less than 10 Ω
14	V	14	30<=> 5	Not applicable	
15	V	15	28<=> 5	Not applicable	
16	1	15	8<=>27	Test engine-speed sensor signal using oscilloscope. Disengage gear and start.	See upper illustration
17	2	15	25<=>26	Test reference-mark sensor signal using oscilloscope. Disengage gear and start.	See middle illustration
18/19	3/4	15		Not applicable	
20	6	15	35<=> 5	Relay 2 (main relay). Voltage supply, control unit. Switch on ignition.	10...15 V
21	7	15	18<=> 5	Relay 2 (main relay). Voltage supply, control unit. Switch on ignition.	10...15 V
22	5	15	1<=> 5	Ignition output stage (control unit). Test ignition signal using oscilloscope. Disengage gear and start.	See lower illustration
23	8	15	9<=> 5	Control unit. Voltage at term. 9 Voltage supply, air-flow sensor. Switch on ignition.	greater than 4,5 V
24	9	15	7<=> 5	Air-flow sensor. Load signal (term. 7) Sensor flap at rest: Fully deflect sensor flap: Switch on ignition.	200...300 m V greater than 4,2 V



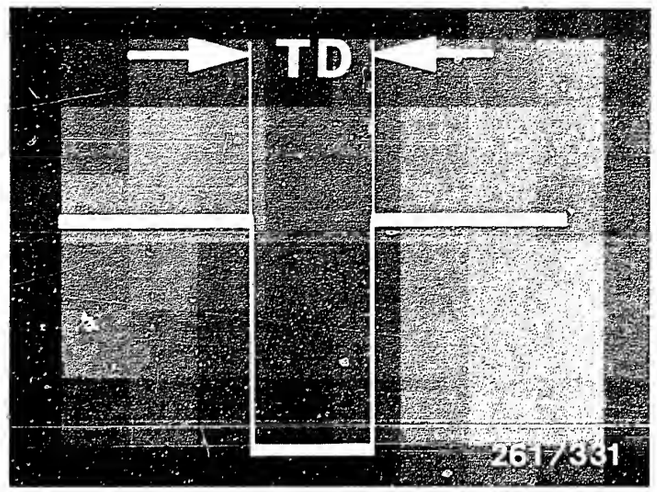


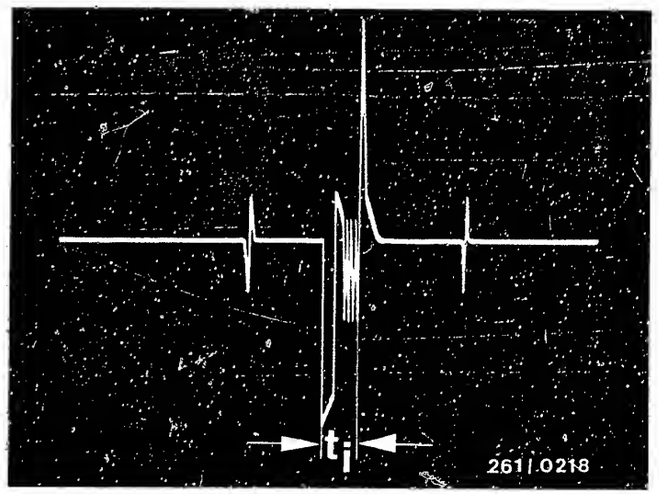


Rapid diagnosis chart for universal test adapter ETT 081.01 (continued)

Adapter cable: 1 684 463 124 Valid for control unit 0 261 200 055

Test step	Switch V	Switch Ω	Terminals	Test of component/function Testing instructions/conditions	Nominal values
25/26	10/11	15		Not applicable	
27	12	15	4<=> 5	Control unit. Starting signal (term. 50) voltage to term. 4. Disengage gear and start.	8...15 V
28	13	15	21<=> 5	Control unit. Test dwell-period signal with oscilloscope. Disengage gear and start.	See upper illustration
29	14	15	14<=> 5	Control unit (fuel-inj. output stage). Test injection signal with oscilloscope. Disengage gear and start.	
30	14	15	14<=> 5	Control unit. Injection duration dependant on engine temperature (NTC II). Press button T1 (simulate cold engine). Duration of injection becomes longer.	See lower illustration
31	15	15	15<=> 5	Control unit (second injection output stage). Test injection signal (otherwise as for Test step 29).	
32	16	15	11<=> 5	Control unit (measuring output). Test injection signal (otherwise as for Test step 29).	
33	17	15	20<=> 5	Control voltage, pump relay term. 85. Switch on ignition.	10...15 V
34	17	15	20<=> 5	Control unit. Pump actuation. Disengage gear and start.	max. 4 V
35	17	15		EKP, pressure regulator. Fuel pressure. Ignition off, connect pressure gauge. Switch on ignition, press button T3.	2.8...3.2 bar





Rapid diagnosis chart for universal test adapter ETT 018.01 (continued)

Adapter cable: 1 684 463 124 Valid for control unit 0 261 200 255

Test step	Switch V	Switch Ω	Terminals	Test of component/function Testing instructions/conditions	Nominal values
36	17	15		Idle speed and CO. Connect motor- and CO-tester, diagnostic cable (1 684 463 122), and let engine run at operating temperature (after pushing button T2, values unchanged).	800...900 min $^{-1}$ 1.0...1.5 vol% CO
37	17	15		Spark advance at idle speed	-2...8° crankshaft
	17	15		Spark advance at full load. Set engine speed of 3000 min $^{-1}$ and press button T6. Be careful with M 745 i (computer-aided trans. shift): First disconnect transmission control unit.	17...27° crankshaft at 3000 min $^{-1}$
38	17	15		Dwell angle at idle speed	10°...16°
				Dwell angle at 2000 min $^{-1}$	15°...28°
39	17	15		Control unit. Check overrun cut-off. Set engine speed of 2500...3000 min $^{-1}$, press button T5. Injection signals stop and then start again at approx.1200 min $^{-1}$.	Engine "surges"
40	V	10		Applies only to the M 745 i (computer-aided trans. shift). No full-load contact! Enrichment via transmission control unit (term. 31). CAREFUL! Voltage measurement at ohm sockets! Transmission control unit connected, pump relay disconnected, position switch at "P", do not press accelerator pedal.	1.Briefly operate starting motor (do not switch off ignition subsequently) > 2 V 2.Full throttle: < 1 V

TEST SPECIFICATIONS

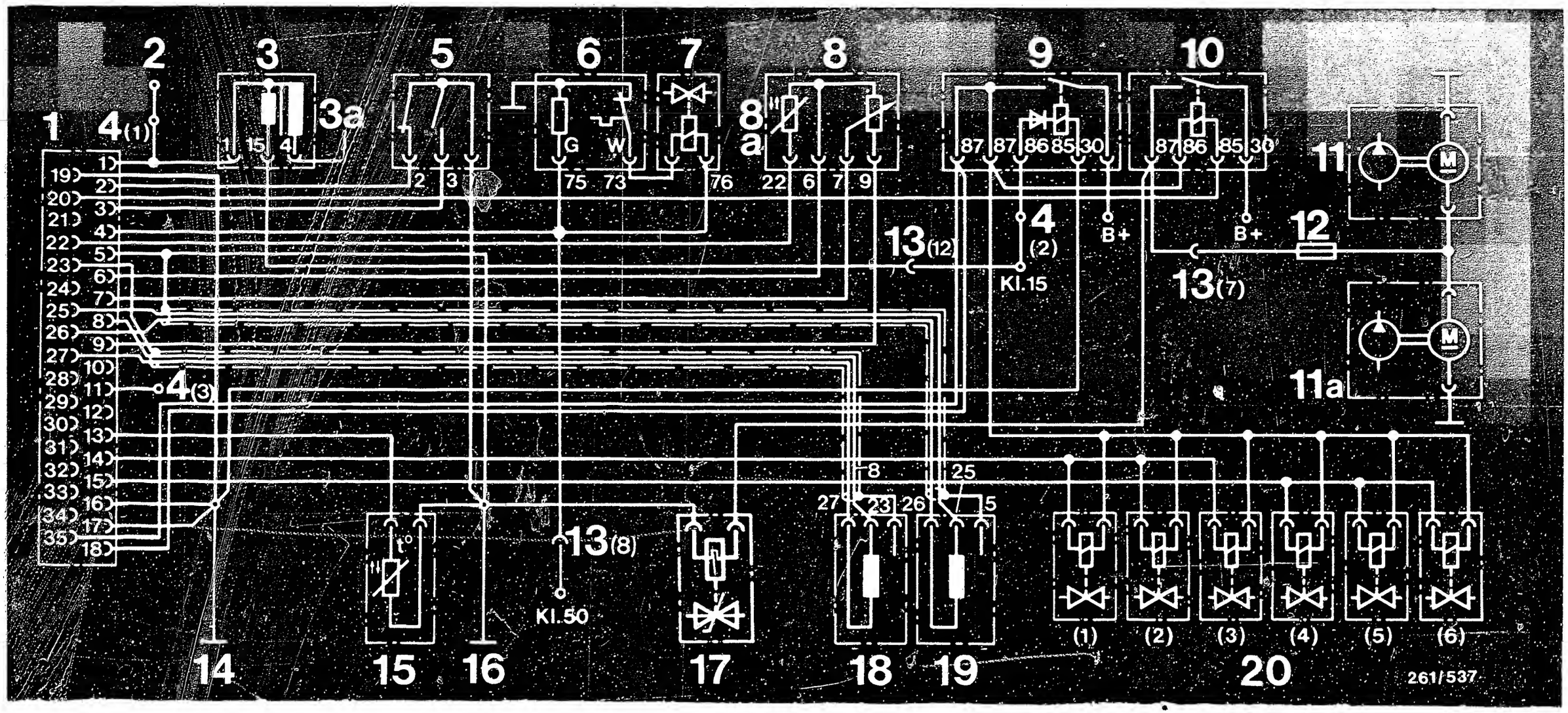
* Idle speed	800...900 min $^{-1}$
* Exhaust-gas adjustment CO level with engine at operating temperature:	1,0...1,5 vol. %
* Pressure regulator Fuel pressure:	2,8...3,2 bar
* Electric fuel pump Delivery quantity (measured in return flow) Pre-supply pump: Connection voltage (under load):	 min. 1125 cm ^{3} /30s above 1200 cm ^{3} /30s min. 12 V
* Temperature sensor (coolant) Electrical internal resistance at:	
Ambient temperature (+15°C...+30°C):	1,45...3,3 k Ω
Engine at operating temper- ature (approx. +80°C):	280...360 Ω
* Solenoid-op. fuel-inj. valve Electrical internal resistance at ambient temperaure (+15°C...+30°C):	 2...3 Ω
* Start valve Electrical internal resistance:	 4 Ω

Test specifications (continued)

* Air-flow sensor	
Electrical internal resistance between term.7 and term.6: term.9 and term.6:	 8...2500 Ω (1) 500...1100 Ω
(1) = (Deflect sensor flap all the way to stop).	
* Temperature sensor (intake air)	
Electrical internal resistance measured at air-flow sensor between term.22 and term.6 at ambient temperature (+15°C...+30°C):	 1,45...3,3 Ω
* Engine-speed and reference-mark sensors	
Electrical internal resistance at ambient temperature (+15°C...+30°C):	 0,6...1,6 Ω
* Auxiliary-air device	
Electrical internal resistance:	 30...65 Ω

* Thermo-time switch

Electrical internal resistance at	Between term. "G" and ground	Between term. "W" and ground	Between terms. "G" and "W"
Ambient temperature (below +30°C)	25...80 Ω	0 Ω	25...40 Ω
Engine at operating temperature (above +40°C)	50...80 Ω	100...160 Ω	50...80 Ω

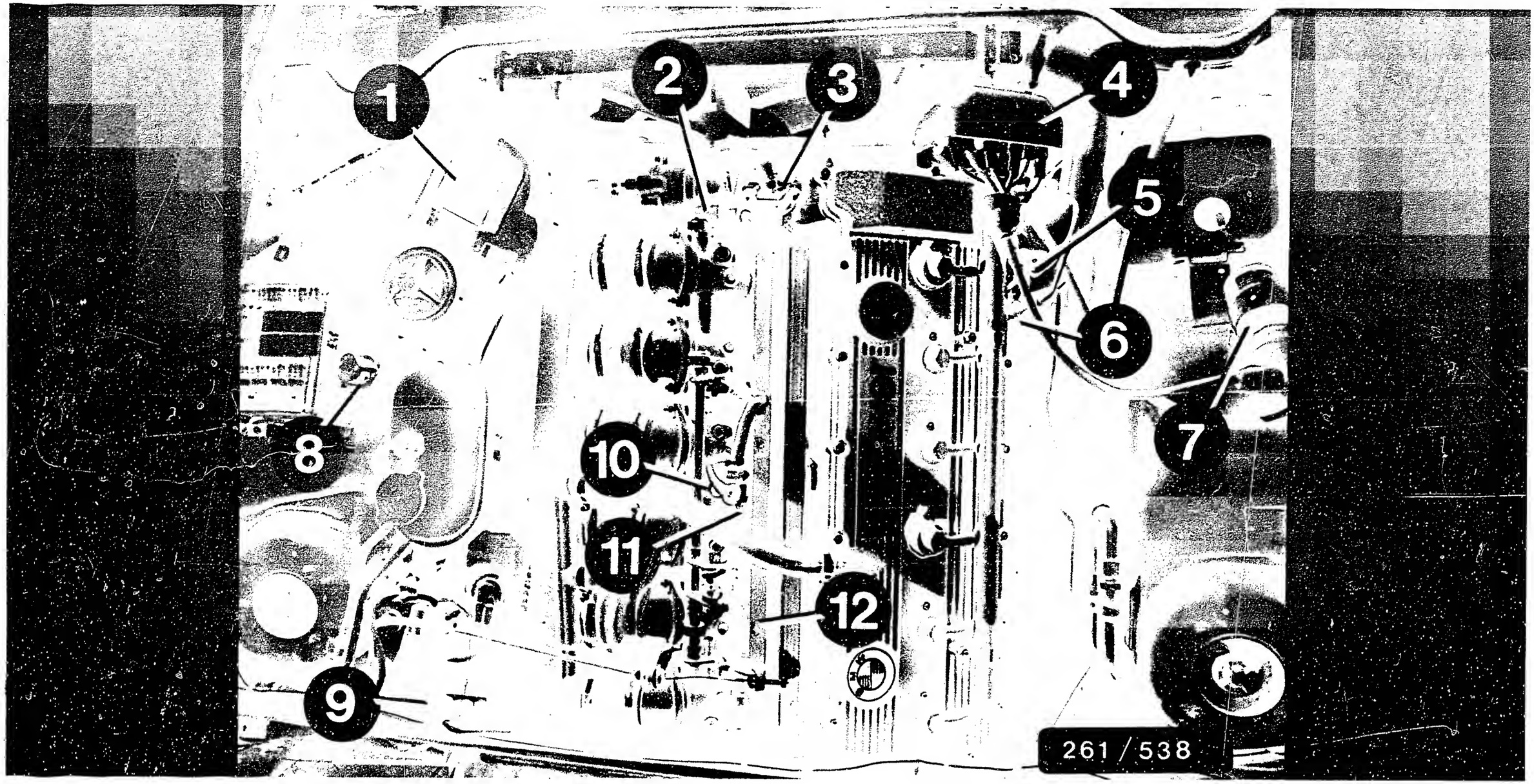


ELECTRICAL TERMINAL DIAGRAM

1 = Control-unit plug
2 = To diagnostic plug and engine-speed sensor
3 = Ignition coil
3a = To high-voltage distributor
4 = Plug connection (3- or 4-pin) in glove compartment
5 = Throttle-valve switch
6 = Thermo-time switch
7 = Start valve
8 = Air-flow sensor
8a = Temp. sensor (intake air)
9 = Relay 2 (main relay)
10 = Relay 1 (pump relay)
11 = Fuel pump
11a = Pre-supply pump
12 = Pump fuse F11
13 = Engine plug (No. 7, 8, 12)
14 = Vehicle ground for control-unit output stages
15 = Temperature sensor (coolant)
16 = Vehicle ground for control unit
17 = Auxiliary-air device
18 = Engine-speed sensor
19 = Reference-speed sensor
20 = Solenoid-operated fuel-injection valves

B17 ⟹

B18 ⟸



INSTALLATION POSITION OF COMPONENTS

1 = Air-flow sensor
2 = Throttle-valve switch
3 = Pressure regulator
4 = High-voltage distributor
5 = Temperature sensor (coolant)
6 = Thermo-time switch
7 = Ignition coil
8 = Diagnostic socket
9 = Plug connections for engine-speed and reference-mark sensors
10 = Idle-speed-adjusting screw
11 = Start valve
12 = Fuel-distribution pipe

Installation position of components (continued)

Information on installation is always with reference to the direction of travel.

* Engine-speed and reference-mark sensors:
  In the starting-motor ring-gear housing at the outer edge of the flywheel ring gear.

* Fuel filter:
  Underneath the vehicle near the fuel tank.

* Fuel pump:
  Underneath the vehicle near the fuel tank.

* Ground lead for electric fuel pump:
  Below the rear seat bench, on the left (depression), ground point on body.

* Control unit:
  In the area of the glove compartment.

* Temperature sensor (intake air)
  In air-flow sensor.

* Central ground:
  On intake pipe of cylinder 5.

* Main and pump relay:
  Near control unit.

B21 <==

For production reasons:
continued on the following coordinate.

B22 => <=

TROUBLE-SHOOTING INSTRUCTIONS : ALF-5000

BOSCH SYSTEM : Dist.-type fuel-inj. pump

VEHICLE MAKE : ALFA-ROMEO

T A B L E O F C O N T E N T S

SPECIAL FEATURES

These trouble-shooting instructions apply to the following Alfa-Romeo models with turbo-diesel engine current at the time of writing:

* Alfa 33	1.8 l - 3 cylinders	(10.86->)
* Alfetta Giulietta	2.0 l - 4 cylinders	(03.83->)
* Alfa 75	2.0 l - 4 cylinders	(05.85->)
* Alfa 90	2.4 l - 4 cylinders	(10.84->)
* Alfetta	2.4 l - 4 cylinders	(04.83->)
* Alfa 6	2.5 l - 5 cylinders	(06.83->)

TEST SPECIFICATIONS

Idle speed	850 $\pm$ 50 min $^{-1}$
Nozzle-opening pressure:	155 + 8 bar
Coordination of pump and engine	
Engine position	1rst cylinder at TDC
Pump position:	
1.8 l Turbo-Diesel	1.00...1.03 mm after BDC
2.0 l Turbo-Diesel	0.97...0.99 mm after BDC
2.4 l Turbo-Diesel	0.78...0.80 mm after BDC
2.5 l Turbo-Diesel	0.88...0.90 mm after BDC

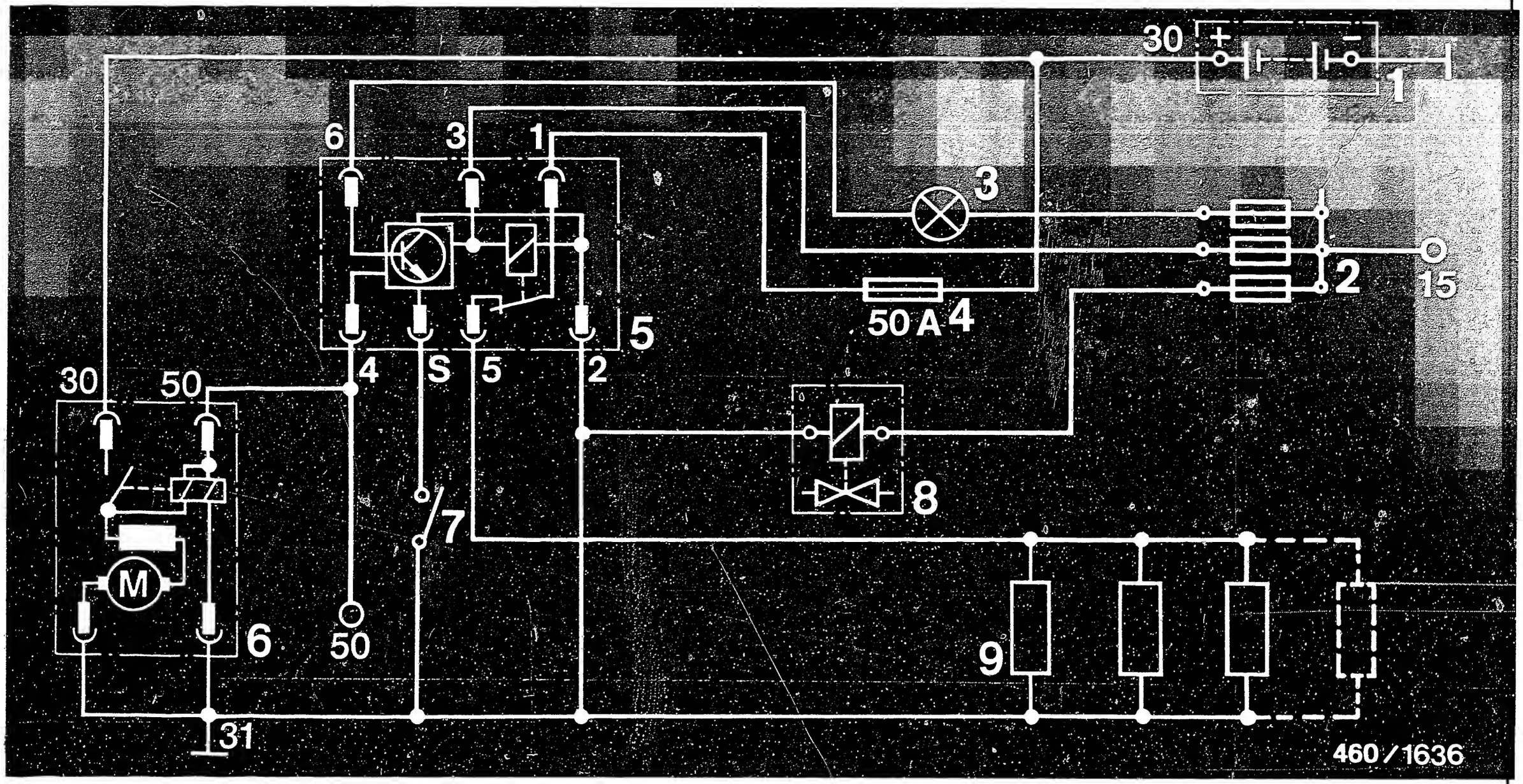
TEST SPECIFICATIONS (CONTINUED)

Compression:	21...22 bar
Charge-air pressure:	0.39...0.45 bar at 4000 min $^{-1}$ without loading, max. 0.88 bar at highest engine speed with loading

Tightening torques:

Fuel-injection pump gear	88 Nm
Nozzle-holder assembly	25...30 Nm
Fuel lines	15...20 Nm
Fastening bolts for fuel-injection pump	25 Nm
Fuel-line inlet-union screws	25 Nm
Screw plug	10 Nm

For production reasons:
continued on the following coordinate.



1 = Battery
2 = Fuse box
3 = Preheating indicator lamp
4 = 50 A fuse
5 = Glow-duration control relay

6 = Starting motor
7 = Microswitch (VE pump)
8 = Solenoid-operated valve
9 = Glow plugs

PREHEATING SYSTEM TERMINAL DIAGRAM

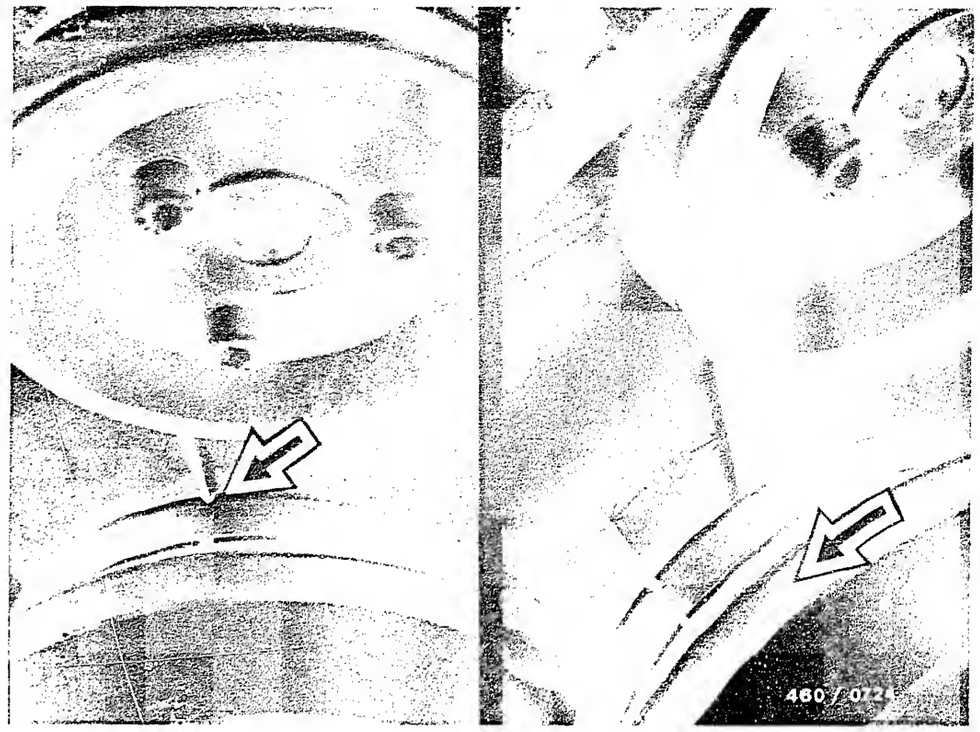
C05 ⟹

C06 ⟸

TEST EQUIPMENT AND TOOLS

Holding and pressing device *	A 7. 0 384 A 3. 0 612	Holding fuel-injection pump drive gear
Pressure-measuring device or pressure gauge, 0...1.6 bar	KDJE-P 100 e.g. W i k a No. 4 184	Testing charge-air pressure
Measuring device	KDEP 1085 KDEP 1126	Pump/engine coordination
Small dial indicator 1/100 mm graduation	1 687 233 011	Pump/engine coordination
Box wrench	KDEP 1115	Loosening/tightening fuel-injection tubing

* = Obtain from Alfa-Romeo dealership



REMOVING THE FUEL-INJECTION PUMP

Disconnect the water hoses at the radiator and remove the radiator (only on 3-cylinder, 1.8 l, Turbo-Diesel)

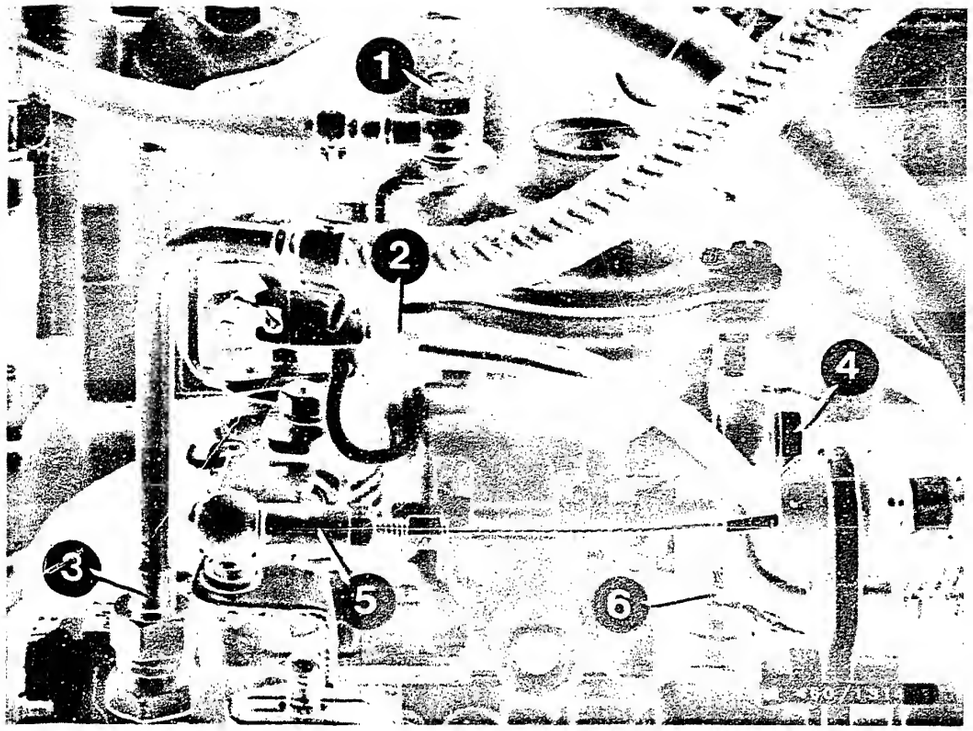
Remove cylinder-head cover.

Turn the crankshaft to TDC of cylinder 1 (on timing-gear side).

The marking on the control housing must be aligned with the belt-gear marking (Fig. a, arrow).

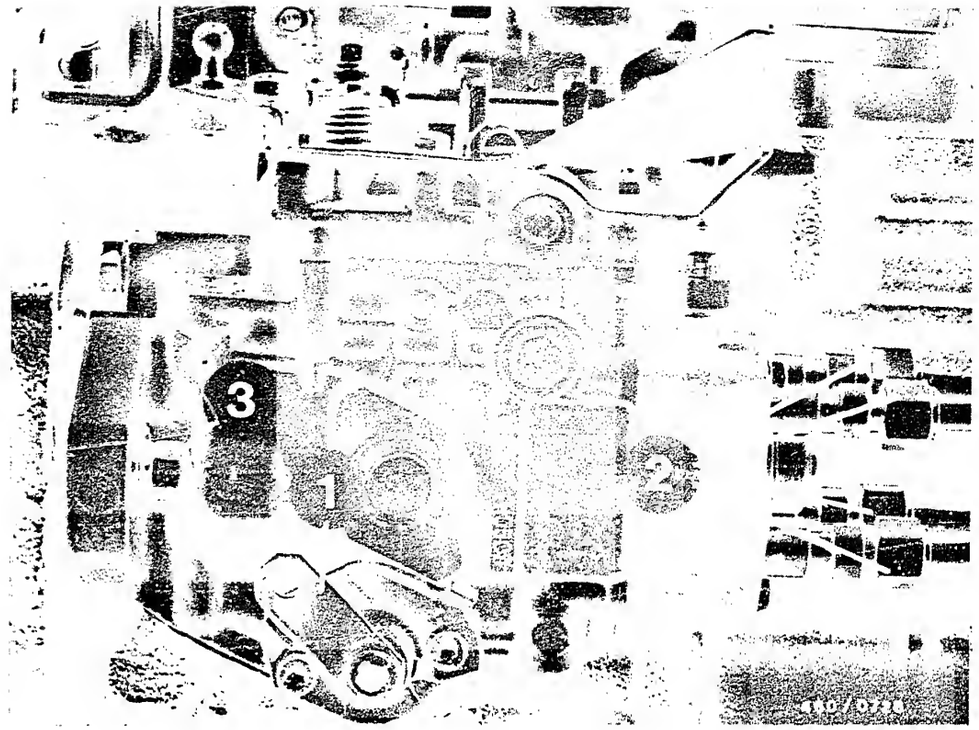
Turn the crankshaft 30° against the direction of engine rotation (Fig. b, direction of arrow).

Remove the battery.



1 = Charge-air pressure connection
2 = Microswitch
(presence depends on engine type)
3 = Fuel supply line
4 = Fuel return line
5 = Bowden cable at control lever
6 = Connection line to ELAB

Remove the charge-air pressure connection, electric cable to microswitch, fuel supply line, return line, bowden cable at control lever of fuel-injection pump, and electric cable to shutoff solenoid.



1 = Bowden cable at cold-start inj. advance
(presence depends upon engine type)
2 = Fuel-injection tubing
3 = Fastening nut

Remove the bowden cable at the cold-start injection advance and the fuel-injection tubing with box wrench KDEP 1115.
(Prevent the delivery-valve holders from turning by counterholding.)

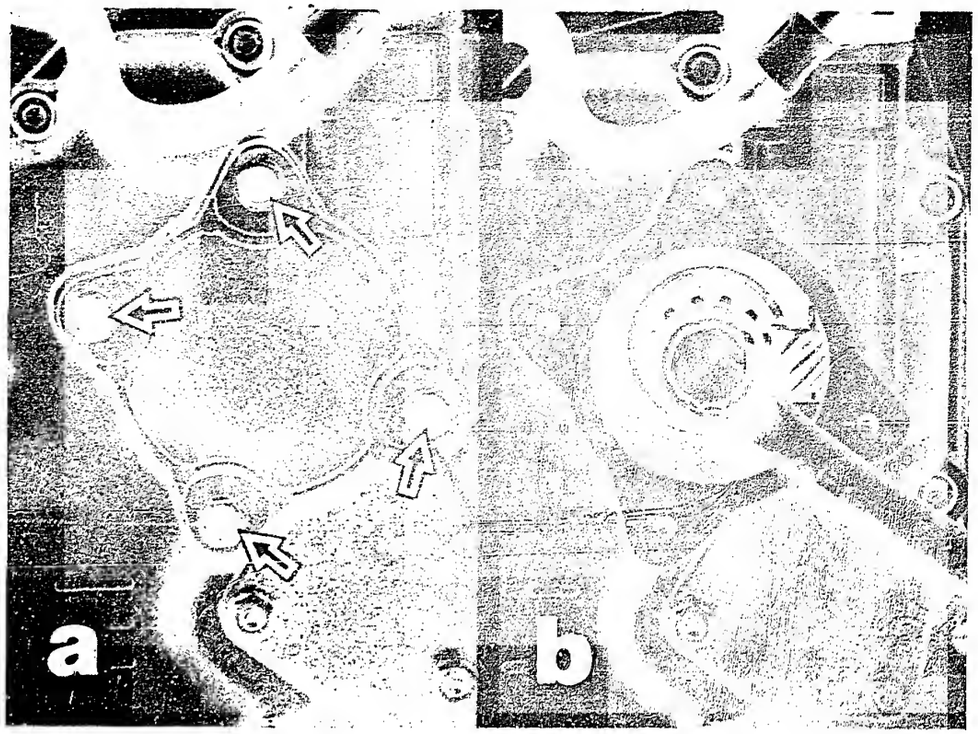
Unscrew the fuel-injection pump fastening nuts.

With fuel-injection pumps with temperature-controlled cold-start injection advance (KSB), pinch off the coolant hoses a short distance behind the control device of the injection pump with commercially available spring clips.

Loosen the hose clamps and pull off the coolant hoses.

Remove the fuel-injection tubing with box wrench KDEP 1115.
(Prevent the delivery-valve holders from turning by counterholding.)

Unscrew the fuel-injection pump fastening nuts.



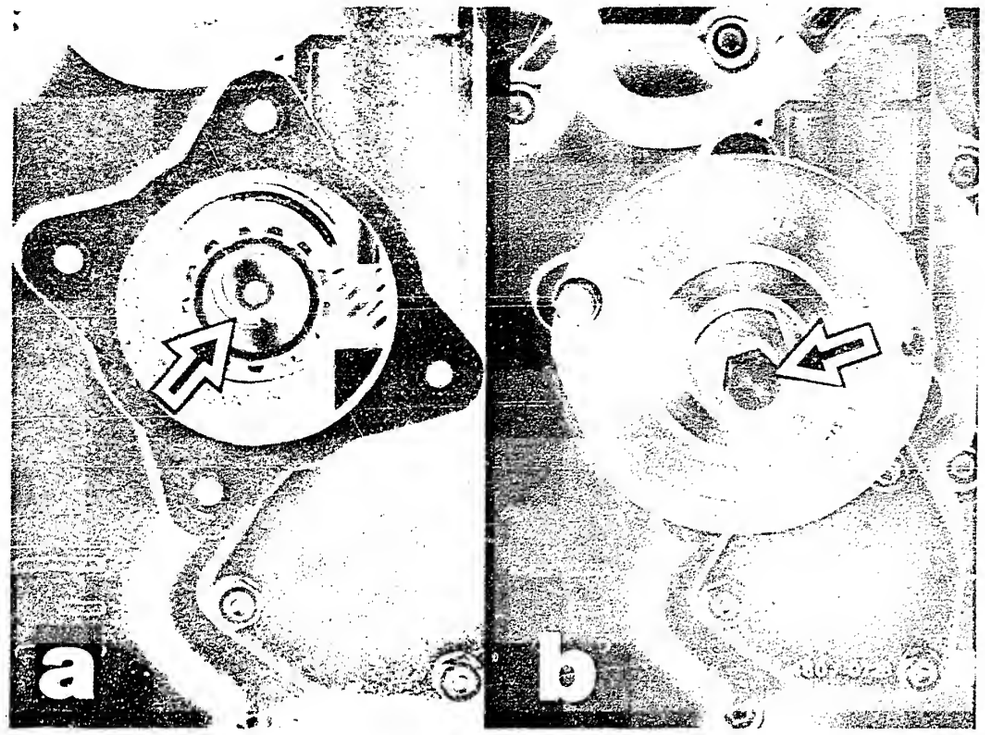
Remove the fastening bolts (Fig. a, arrows) from the cover of the injection-pump drive gear.

Remove the cover.

Unscrew the fuel-injection pump gear fastening screw (Fig. b).

In order to prevent the crankshaft from turning, put car into gear and pull the parking brake.

Note for removal:
On covers with screw-thread insert, use holding and pressing device A 3. 0 612 for the subsequent pump removal.



Screw holding and pressing device A 7. 0384, or A 3. 0612 into the drive gear of the vacuum pump (Fig. a, arrow).

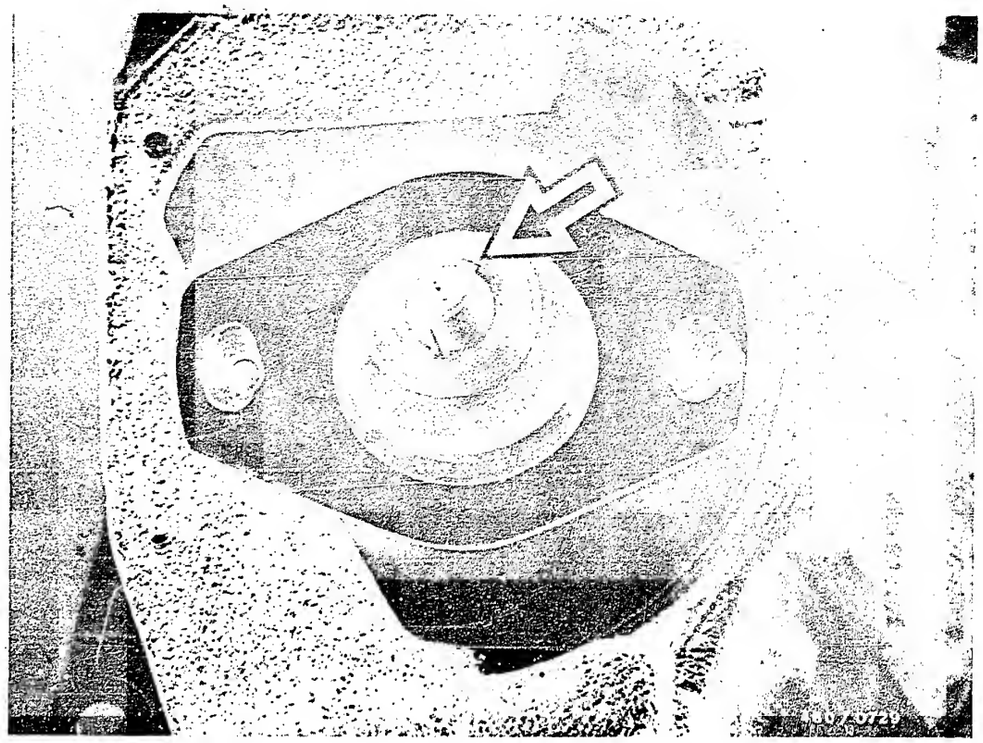
Lock the device with a bolt from the gear cover (Fig. b).

Press the injection-pump drive shaft out of the drive gear by screwing in the pressing screw (Fig. b, arrow).

Remove the fuel-injection pump from the engine.

N o t e :

Do not alter the crankshaft position with the holding device mounted.



INSTALLING THE FUEL-INJECTION PUMP

Turn the fuel-injection pump drive shaft until the keyway points to outlet "A".

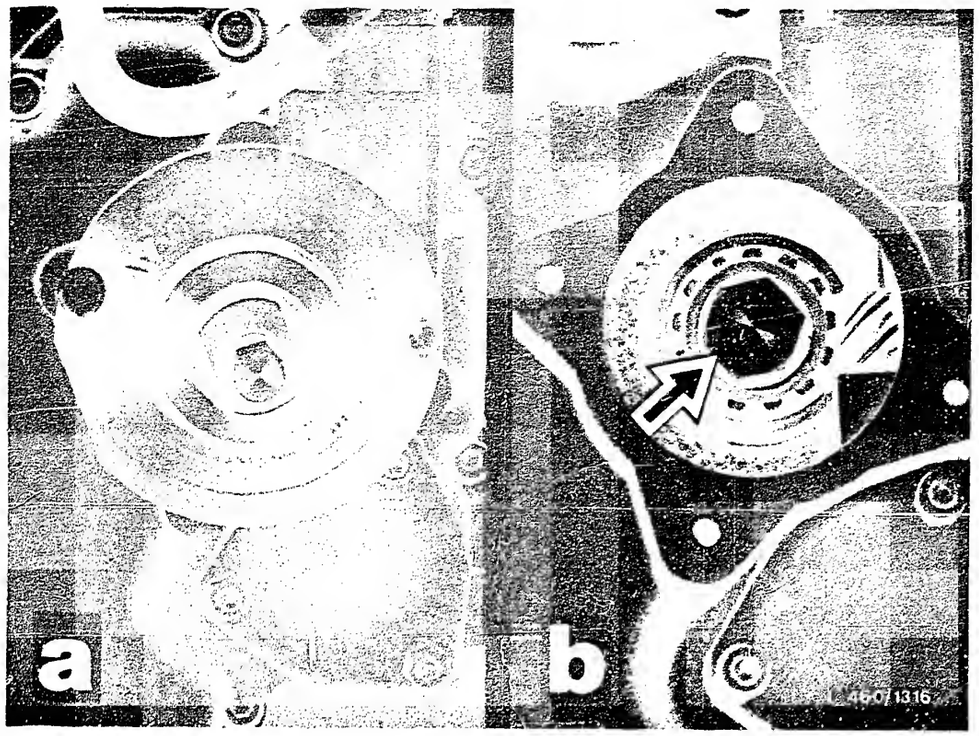
Install the injection pump in such a manner that the drive-shaft Woodruff key engages in the upper key space (arrow) of the drive gear.

I n s t a l l a t i o n n o t e :

To make installation easier, use grease to place the washer and spring lock washer of the rear stay bolt on the pump flange.

Pivot the fuel-injection pump into the middle position of the slots.

Put on and slightly tighten the fastening nuts.



Remove the holding and pressing device (Fig. a).

Screw in the fastening screw for the injection-pump gear and tighten to 88 Nm (Fig. b, arrow).

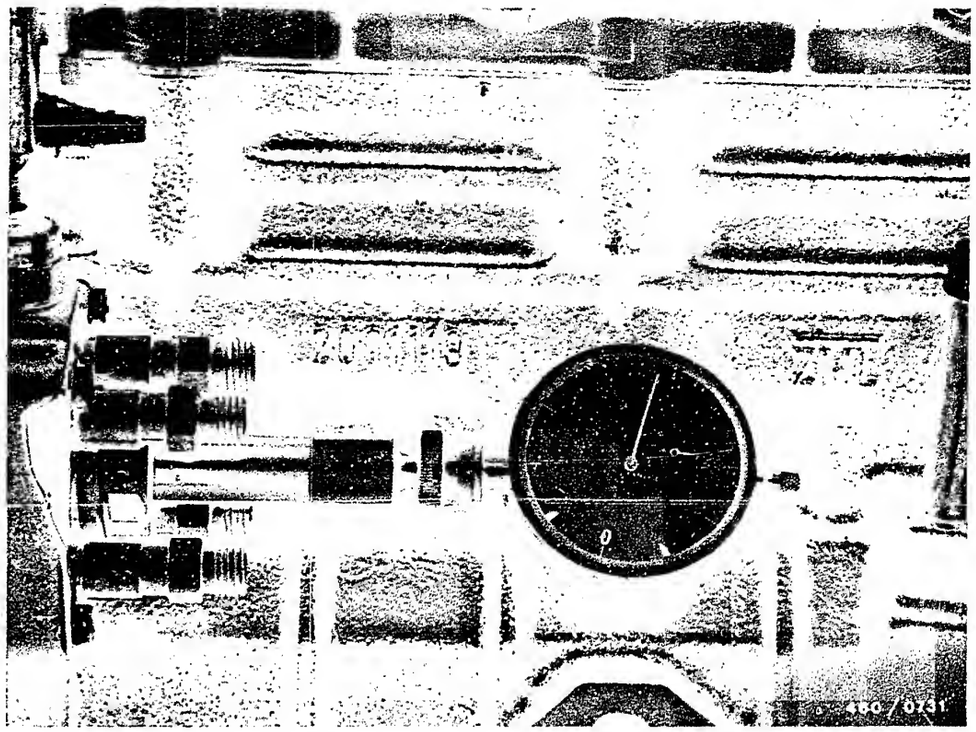
N o t e :

In order to prevent the crankshaft from turning, put vehicle in gear and pull the parking brake.

Mount the cover.

Disengage gear.

Turn the crankshaft in the direction of engine rotation until the marking on the belt gear is aligned with the TDC marking on the control housing.



Screw the bleeder screw out of the central screw plug (triangle-head bolt) of the distributor head.

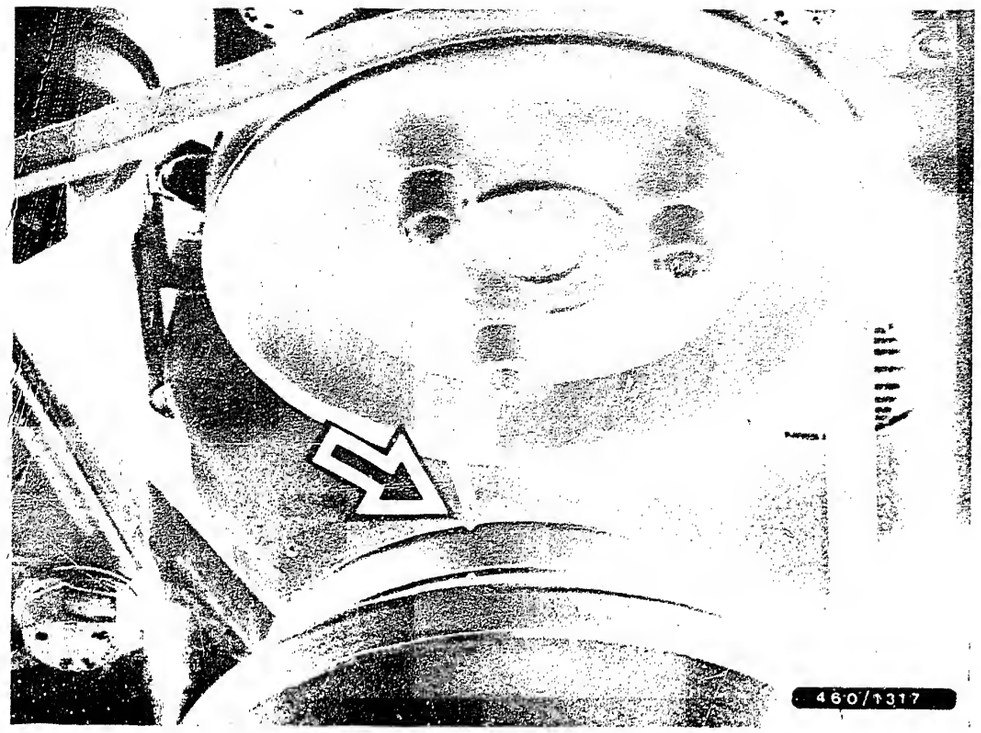
Mount measuring device KDEP 1085 or 1126 with dial indicator, e.g. 1 687 233 011, in this hole, and pre-tension approx. 2 mm.

Turn the crankshaft against the direction of engine rotation until the needle of the dial indicator no longer moves.

Set the dial indicator to "0".

N o t e :

When testing and adjusting start of delivery, the temperature-controlled cold-start injection advance (where present) must be in zero position.



Turn the crankshaft in the direction of engine rotation until the belt gear marking is aligned with the TDC marking on the control housing (see illustration, arrow).

At this crankshaft position, the dial indicator on the injection pump should show a pump-piston stroke, depending on engine type, of:

1.8 l	Turbo-Diesel	1.00...1.03 mm
2.0 l	Turbo-Diesel	0.97...0.99 mm
2.4 l	Turbo-Diesel	0.78...0.80 mm
2.5 l	Turbo-Diesel	0.88...0.90 mm

after TDC.

Where necessary, undertake correction by pivoting the fuel-injection pump.

Tighten the fuel-injection pump fastening bolts to 25 Nm.

Remove measuring device KDEP 1085 or 1126 with dial indicator.

Screw in the bleeder screw with a new seal ring.

Tighten fuel-injection tubing with box wrench KDEP 1115 (prevent delivery-valve holders from turning by counterholding).

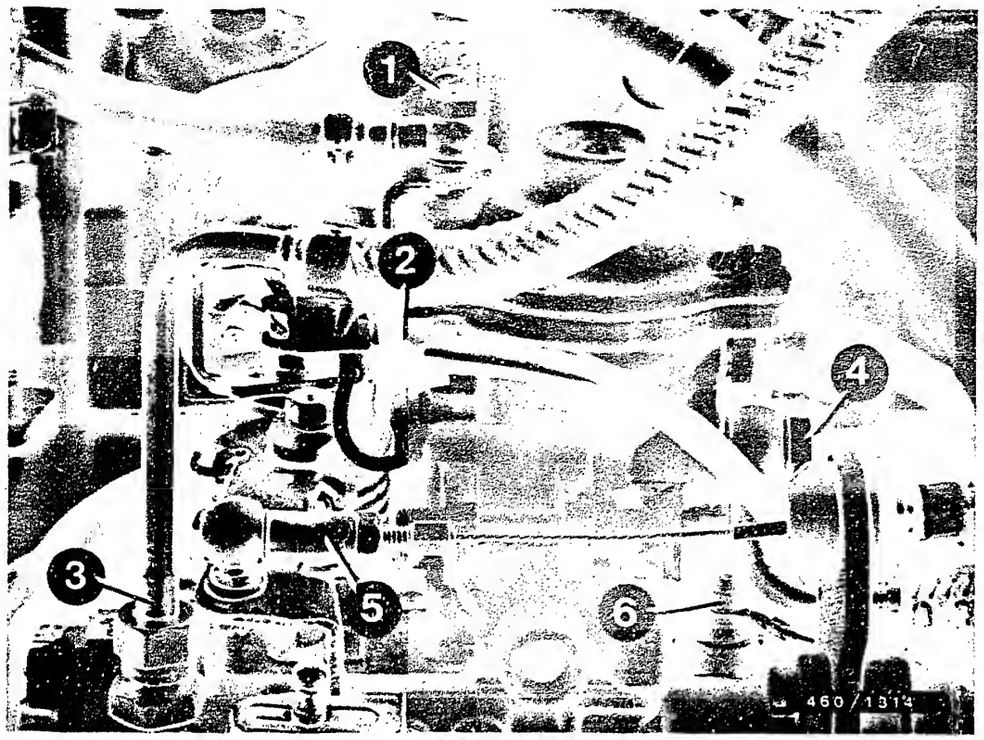
Connect the bowden cable to the cold-start injection advance and coolant lines to the control devices of the injection pump.

Tighten hose clamps and remove spring clips.

Mount the cylinder-head cover.

Install the battery.

Install the radiator (only on 3-cylinder 1.8 l Turbo-Diesel).

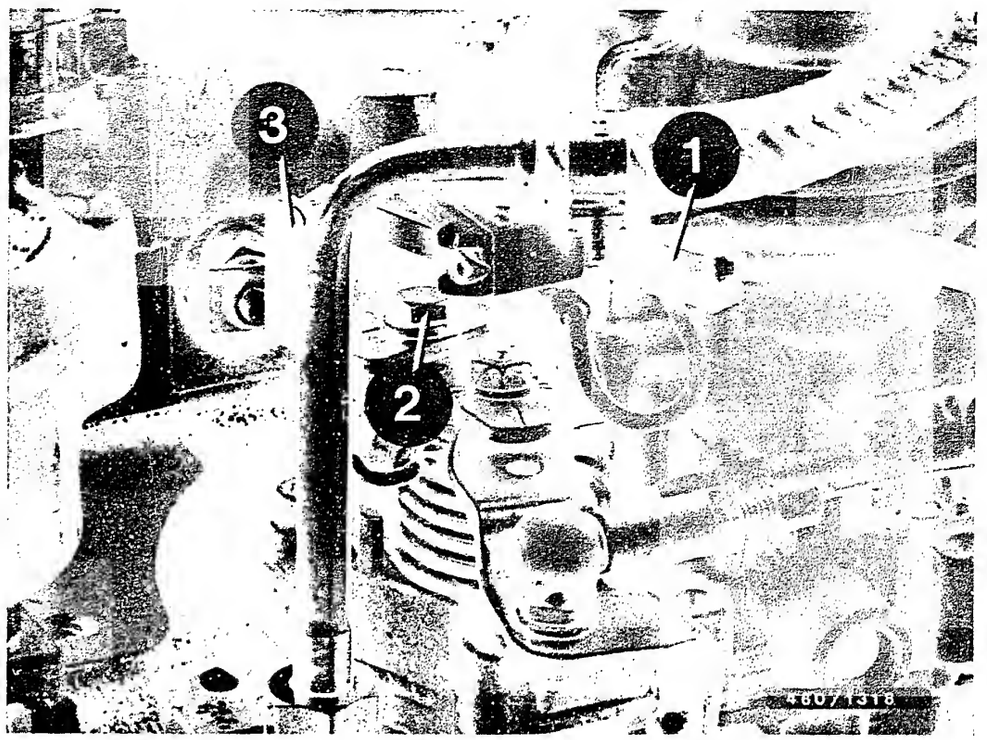


1 = Charge-air pressure connection
2 = Microswitch
(presence depends on engine type)
3 = Fuel supply line
4 = Fuel return line
5 = Bowden cable at control lever
6 = Connection cable to ELAB

Restore the charge-air pressure connection, electric lead to microswitch, fuel supply line, return line, bowden cable at control lever of fuel-injection pump, and electric cable to shutoff solenoid.

N o t e :

The inlet-union screw of the fuel return line has a restriction bore, and is marked with the word " O U T " on the screw head.



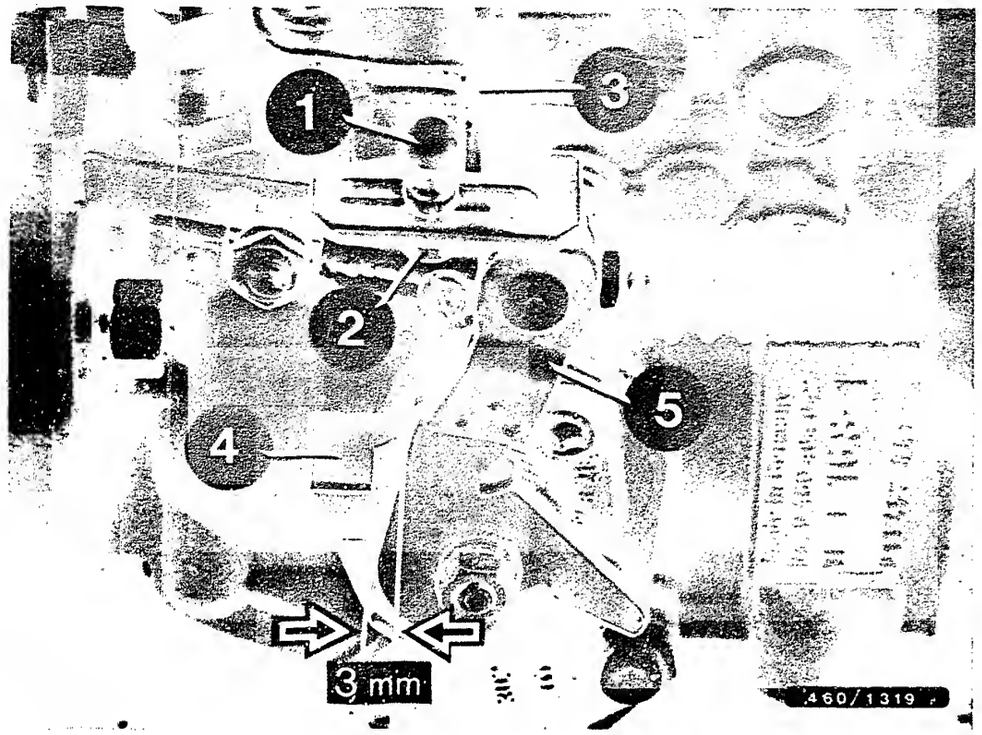
1 = Plug connector
2 = Hex-head bolt
3 = Switch clip

Adjusting the microswitch to switch off the preheating system

P r e r e q u i s i t e :
* Idle speed set.

Insert a 5.5 mm spacer between the control lever and the idle stop screw.
Pull the plug connector from the microswitch.
Connect the test lamp to the free connection of the microswitch and the battery positive terminal. Loosen the hex-head bolt and set the switching point of the microswitch by moving the switch clip.

N o t e :
This adjustment guarantees that the glow plugs are switched off in the post-heating phase above 1300...1900 min $^{-1}$ ..



1 = Ball head
2 = Hex nut
3 = Engine-speed control lever
4 = Stop
5 = Control lever (cam roller ring)

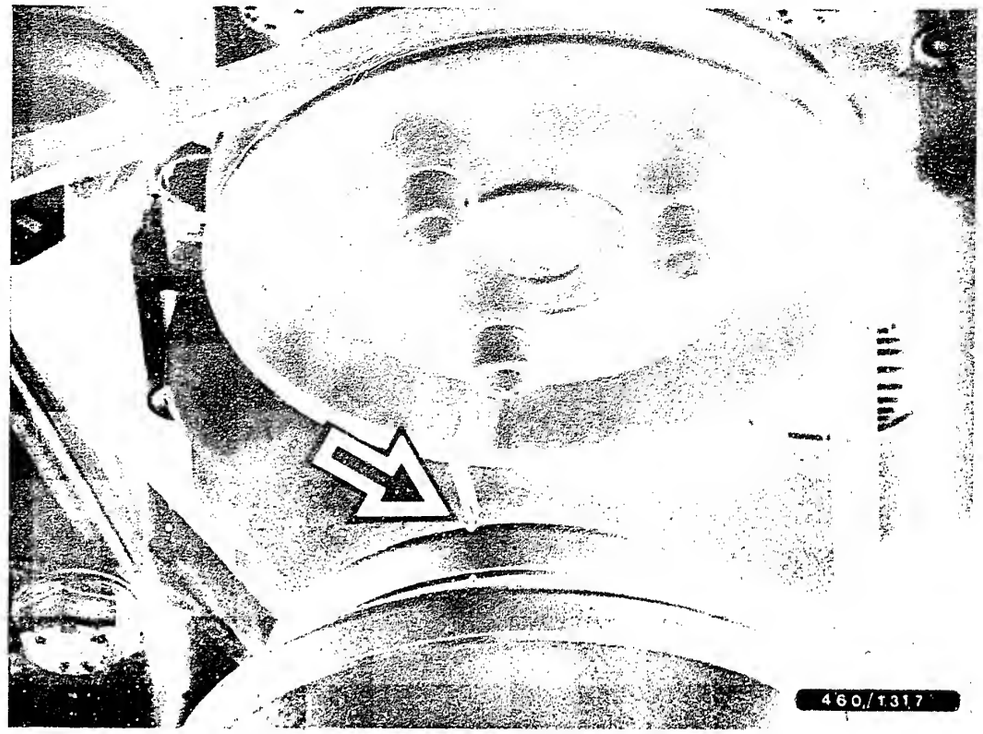
Adjusting idle increase

Prerequisite:
* Idle speed set
* Coolant temperature at least 40° C

Disengage the throttle cable from the control lever. Insert a 3 mm spacer between the control lever and stop.

Start the engine and run at 1000...1100 min $^{-1}$.

Loosen the hex nut and position the ball head at the control lever.
Tighten the hex nut, remove the spacer, and fasten the throttle cable.



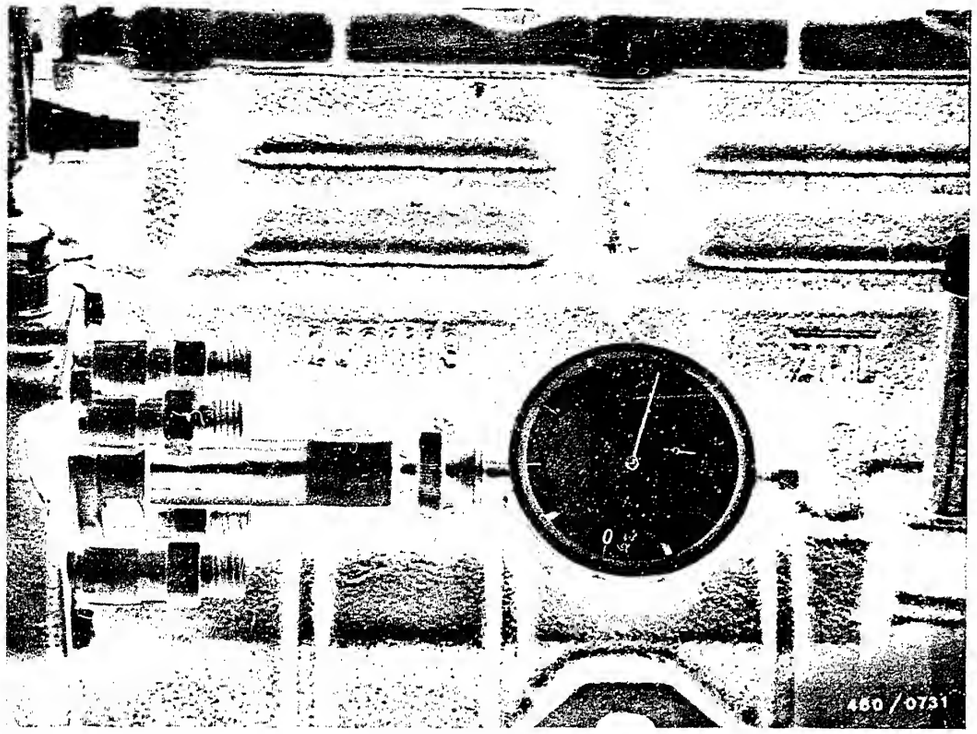
COORDINATING THE FUEL-INJECTION PUMP AND ENGINE

Remove the cylinder-head cover.

Turn the crankshaft to TDC of cylinder 1 (on timing gear side).

The marking on the control housing must be aligned with the belt-gear marking (see illustration - arrow).

When testing and adjusting start of delivery, the temperature-controlled cold-start injection advance (where present) must be at zero position.



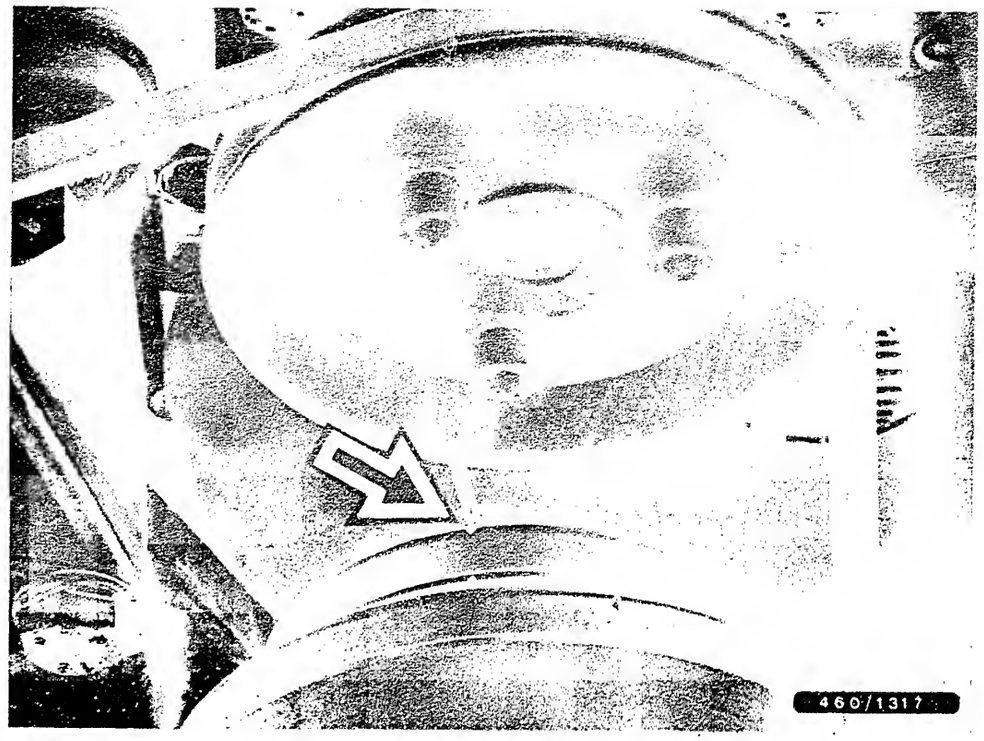
Remove injection tubing at fuel-injection pump and nozzle-holder assemblies with box wrench KDEP 1115 (prevent loosening of the delivery-valve holders by counterholding).

Remove the bleeder screw from the central screw plug (triangle-head bolt) of the distributor head.

Mount measuring device KDEP 1085 or 1126 in this hole.

Insert dial indicator (e.g. 1 687 233 011) and pre-tension about 2 mm.

Turn the engine crankshaft against the direction of engine rotation until the dial-indicator needle no longer moves.



Set dial gauge to "0".

Turn the crankshaft in the direction of engine rotation until the belt-gear marking is aligned with the TDC marking on the control housing (see illustration - arrow).

At this crankshaft position, the dial indicator at the injection pump must show, depending on the engine type, a pump-piston stroke of:

1.8 l	Turbo-Diesel	1.00...1.03 mm
2.0 l	Turbo-Diesel	0.97...0.99 mm
2.4 l	Turbo-Diesel	0.78...0.80 mm
2.5 l	Turbo-Diesel	0.88...0.90 mm

after BDC.

If necessary, correct by pivoting the fuel-injection pump.

Tighten injection-pump fastening bolts to 25 Nm.

Remove measuring device KDEP 1085 or 1126 and dial indicator.

Install the bleeder screw with a new seal ring.

Tighten fuel-injection tubing with box wrench KDEP 1115 (prevent turning of the delivery-valve holders by counterholding).

Install the cylinder-head cover.

TESTING CHARGE-AIR PRESSURE

When working on the turbo-supercharger, note that even the smallest contamination particles can lead to the destruction of the supercharger.
For this reason, n e v e r operate the engine without an air filter.

To test the charge-air pressure, use pressure testing device KDJE-P 100, or a 0 ... 16 bar pressure gauge (e.g. Wika No. 4184).

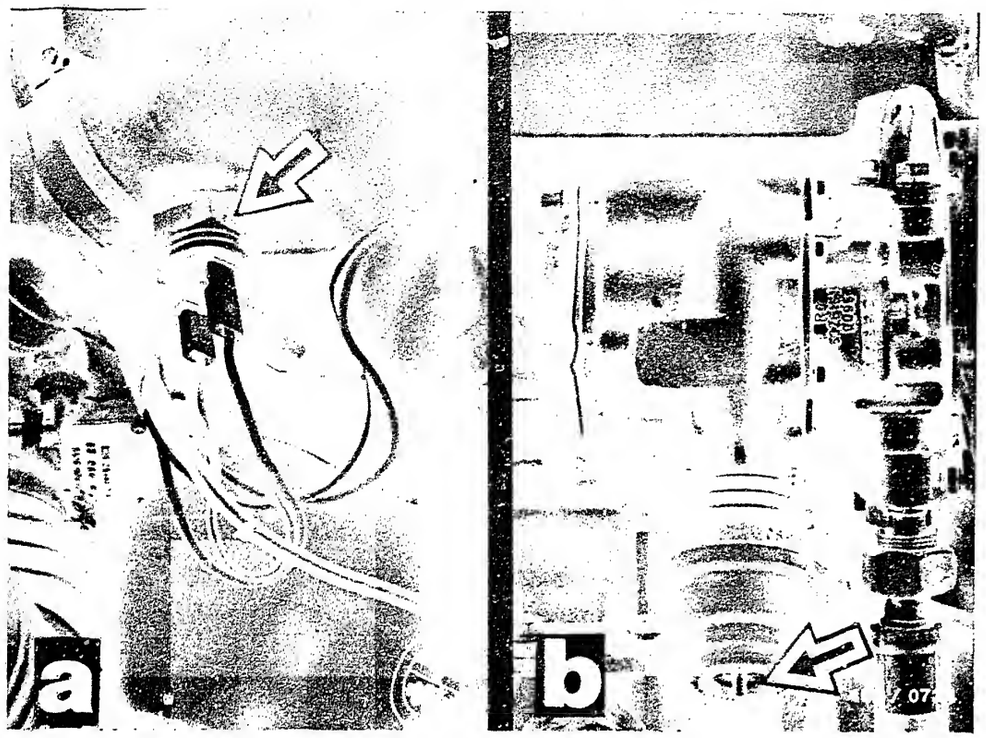
The charge-air pressure can be measured while the vehicle is stationary or during driving.

MEASURING CHARGE-AIR PRESSURE

N o t e :

The following are requirements for testing the exhaust turbo-supercharger:
Engine at normal operating temperature, start of delivery and nozzle-opening pressure correctly set, no leakage on either induction or exhaust side, mechanical condition of engine (valve clearance, compression) OK.

After installing a new exhaust turbo-supercharger, fill the supercharger with oil and run the engine about 1 minute in idle to ensure the proper supply of oil to the supercharger.



Installing the pressure-measuring device for charge-air pressure measurement

Remove the pressure switch on the charge-air pipe (Fig. a, arrow).

Screw in a 12 x 1.5 fitting and connect with pressure gauge using commercially-available hose.

* Charge-air measurement with vehicle stationary without loading:
  At 4000 min^{-1} = 0.39...0.45 bar

* Charge-air pressure measurement during driving with loading:
  At highest engine speed max. 0.88 bar

Charge-air pressure excessive/insufficient (no leakage)

Adjust the charge-air-pressure control valve (Fig. b, arrow), if necessary replace the turbo-supercharger.

For production reasons:
continued on the following coordinate.

Trouble-shooting instructions : PEU - 5002

Bosch system : VE - EDC

Vehicle make : PEUGEOT

Basic microcard : PKW-024

T A B L E O F C O N T E N T S

SPECIAL FEATURES

These brief instructions apply to the following Peugeot model current at the time of writing:

505 Turbo-Diesel
with electronic control of diesel fuel injection (EDC = Electronic Diesel Control)

Engine: XD3T 2.5 l, 70 kW (95 bhp)
EU, USA 03.87 ->

USE

These brief instructions essentially contain vehicle-specific special features and test specifications (nominal values).

The trouble-shooting chart leads to the various causes/component defects on the basis of the customer complaint. Detailed instructions on trouble-shooting can be found using the trouble-shooting chart of the basic instructions.

NOTE:
The nominal values, terminal assignments, and special features of these vehicle-specific brief instructions are always binding even when reference is made to a basic instruction.

SAFETY AND PRECAUTIONARY MEASURES

These measures must be observed in order to prevent damage to the engine, control units, and peripheral components of the EDC.

1. Disconnect 7-pin plug connector at distribution-type fuel-injection pump prior to compression testing.

2. For nozzle-holder assemblies with inductive start-of-injection sensors, for after-sales-service purposes, correction of the needle-opening pressure only is permissible.

3. Never start the engine without the battery firmly connected.

4. Do not use a fast charger to start the engine.
   Render starting assistance only with a second 12 V battery and jumper cables.

5. Disconnect the battery from the vehicle electrical system prior to boost charging.

6. Never disconnect the battery from the vehicle electrical system with the engine running.

7. Never plug or unplug the control-unit plugs with the ignition on.

8. Remove the control units prior to exposure to temperatures above +80°C (paint-drying installation).

9. Remove the control units prior to welding work (electric spot welding).

TROUBLE-SHOOTING CHART

Customer complaint (symptom of trouble)

1. Trouble lamp lights up/blinks	2. Starting motor operates, engine does not start or starts only with difficulty (hot or cold)	3. Engine surges in idle	4. Uneven idle with engine warm	5. Excessive fuel consumption together with inadequate engine power and smoke formation	6. Unsatisfactory performance	7. Black smoke in full-load range together with rough engine running, poss. insufficient power	8. Rough engine running	Cause (component fault)
*								Self-diagnostics
	*							Voltage supply, control units
	*							Electromagnetic actuator for quantity
	*							Angle potentiometer
	*							ELAB
	*				*		*	Computer monitoring
					*		*	Solenoid-valve – start of injection
					*			EGR pressure transducer
					*			Nozzle-holder assemblies with NMS
					*			Computer linkage
		*					*	Engine-speed sensor
	*							Engine-speed sensor and NMS
	*							Tank empty, tank ventilation
	*		*			*		Injection sequence not ignition sequence
		*						Reducer bushing, supply/return flow
	*		*					Air in fuel system
	*							Paraffin deposits
	*			*				Leakage in fuel lines
	*							Supply lines blocked
	*		*	*		*	*	Fuel-injection nozzles
	*		*	*		*		Pump-engine coordination
	*							Fuel filter
	*							Preheating system
	*		*	*				Compression – engine
	*	*	*	*		*		Fuel-injection pump
				*				Engine air filter
				*				Engine timing
						*		Timing device
					*			Turbo-supercharger

Customer complaint (symptom of trouble)

9. Engine missing during vehicle operation
10. Engine cuts off automatically
11. Engine runs at constant speed
12. Engine will not rev up in cold condition
13. Increased idle speed or uneven engine running at high engine speeds
14. Black smoke in full-load range
15. Fog-like smoke (white) in full-load range

9	10	11	12	13	14	15	Cause (component defect)
	*						Accelerator pedal
*							Electromagnetic actuator for quantity
*			*				Angle potentiometer
*							Computer monitoring
*							Engine-speed sensor and NMS
*	*		*			*	Tank empty, tank ventilation
	*		*			*	Injection sequence not ignition sequence
*			*			*	Reducer bushings supply/return flow
*			*			*	Air in fuel system
			*				Paraffin deposits
*							Leakage in fuel lines
*			*			*	Supply lines plugged
			*			*	Pump-engine coordination
			*			*	Fuel filter
			*				Compression, engine
			*			*	Fuel-injection pump
					*		Exhaust-gas recirculation

Customer complaint (symptom of trouble)

16. Cruise control (FGR) not functioning
17. Cruise control cannot be switched off
18. Road speed cannot be reassumed
19. Exhaust-gas recirculation not functioning

16	17	18	19	Cause (component defect)
		*		Computer monitoring
		*		Solenoid-operated valve - start of inj.
		*		EGR pressure transducer
		*		Nozzle holders with NMS
*		*		Engine-speed sensor
*		*		Road-speed sensor
*				Transmission-shift valve
*				Cruise-control ON switch
*	*			Clutch/brake switch
	*			Cruise-control OFF switch
		*		Cruise-control ACTIVATE switch
			*	Air-flow sensor
			*	Temperature sensor - air
			*	Temperature sensor - engine

TROUBLE-SHOOTING

* Using the self-diagnostics

The control units of the electronic diesel-injection control (EDC = Electronic Diesel Control) are equipped with a self-diagnosis system for the detection of faulty peripheral components and current paths.

For this reason, all trouble-shooting (testing) must begin with the self-diagnostics.

If several faults can be called up one after the other via the self-diagnostics, note down the blink codes. If the voltage supply for the control units is interrupted, the faults stored in memory are erased. This means that faults not actually occurring (e.g. intermittent loose contacts) cannot be identified as causes of trouble.

If a faulty function path is indicated, pay particular attention to the following:

* Loose contacts at multiple-pin plug connections
* Dirty, pushed back, or corroded plug pins.
* Lead breakage at pinch or kink points.

Note for testing:

Always switch off the ignition prior to unplugging or plugging the control-unit plugs.

After repair, clear the stored fault blink code and initiate self-diagnosis again as a check.

BLINK-CODE EVALUATION

An integrated self-diagnosis system in the two control units (output only through control unit 2) makes it possible to localize a defective component or current path via blink codes. The codes are displayed by an indicator lamp in the instrument panel which lights up or flashes in case of a defect (Figure a).

The diagnosis program is activated by pressing the diagnosis button (Test).

The program then starts with a start code 1.2 (= 1 flash - pause - 2 flashes) and ends with an end code 1.1.

The sequences of flashes shown between the start and end codes indicate the faulty function path.

If there are no faults, the indicator lamp goes out as soon as the engine is running, i.e. when there are engine-speed pulses.

If a minor fault is present (e.g. temperature sensor (intake air) defective), the indicator lamp goes out approx. 30 seconds after the engine is started. Within this period, both currently present as well as stored (past) faults are displayed to the driver. If the indicator lamp is out, the blink code can be called up again by pressing the diagnosis button.

In case of serious faults, the indicator lamp remains in the indicating mode (continuous light) after the engine has been started. The indicator lamp is actuated only as long as the fault is actually present (no display of faults in memory).

Blink-code evaluation

1. Press diagnosis button (test) for at least 1 second to prevent faulty actuation.

2. Start code 1.2 of diagnostic program is indicated.

3. Wait until the indicator lamp comes back on, and then press the test switch again.

4. The blink code for the defective component is displayed.

5. Press the diagnosis button again. If there are no further defects, end code 1.1 is displayed.

Blink-code clearing

1. Switch on ignition.

2. Operate brake pedal and test switch simultaneously for at least 1 second.

3. Call up the diagnostic program again by pressing the diagnosis key.

4. If end code 1.1 is displayed after start code 1.2, the stored blink code for the defective component has been erased.

* Self-diagnostics key (blink codes)

1.1 Program end code
1.2 Program start code
1.3 Temperature sensor (intake air) *
1.4 Temperature sensor (coolant) *
1.5 Temperature sensor, fuel *
2.1 Accelerator pedal
2.2 Angle potentiometer
2.3 Electromagnetic actuator for quantity
2.4 Road-speed sensor *
2.5 Cruise-control pressure transducer *
3.1 Atmospheric-pressure sensor *
3.3 Air-flow sensor
3.4 Exhaust-gas recirculation pressure transducer
4.1 Engine-speed sensor
4.2 Needle-motion sensor
4.3 Start-of-injection solenoid-operated valve
5.1 Computer linkage, control unit (fault in memory)
5.2 Computer linkage, control unit (current fault)
or computer monitoring - control unit 1

Continuous light (no blink code can be accessed): computer monitoring - control unit 2

N o t e:

* = Minor faults, self-diagnosis display lamp goes out 30 seconds after the engine has been started.

SELF-DIAGNOSIS TEST TABLE

Defect-indic. Blink code	Test of component/function	Test instructions/conditions	Terms.	Nominal values
1.3	Temperature sensor (intake air)	Test resistance at air-flow sensor at +15...+30°C. Test measurement voltage (control unit) at disconnected cable connector.	1 – 4 1 – 4	1.3...3.6 k Ω approx. 5 V
1.4	Temperature sensor (coolant)	Test resistance at component. +15...+30°C: approx. 80°C: Test measuring voltage (control unit) at disconnected cable connector.		1.3...3.6 k Ω 250...390 Ω approx. 5 V
1.5	Temperature sensor, fuel	Carry out tests at 7-pin cable plug for the EDC-VE pump with the help of test adapter KDEP 1160 or KDEP 1165. * Ground connection Connect adapter to cable connector for fuel-injection pump * Short circuit Connect adapter to cable connector for fuel-injection pump * Internal resistance at +15...+30°C: (Connect adapter to cable connector for fuel-inj. pump) * Measuring voltage (control unit): (Connect adapter to cable connector for control unit)	 5 – gr. 6 – gr. 4 – 6 5 – 6 5 – 6	 > 1 M Ω > 1 M Ω > 1 M Ω 1.2...4.0 k Ω approx. 5 V
2.1	Accelerator pedal	Carry out tests on component. * Internal resistance * Supply voltage * Voltage signal – idle position – full-load position	 1 – 3 1 – 3 (–) (+) 1 – 2 1 – 2	 1.6...2.4 k Ω 4.8...5.2 V 0.45...0.55 V 4.00...4.50 V

SELF-DIAGNOSIS TEST TABLE (CONTINUED)

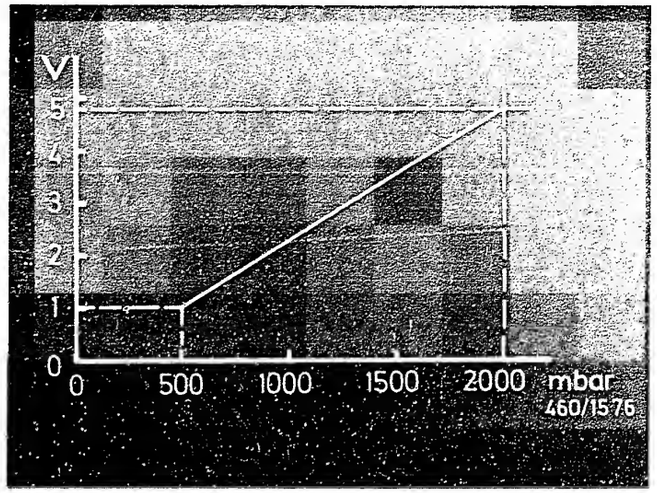
Defect-indic. Blink code	Test of component/function	Test instructions/conditions	Terms.	Nominal values
2.2	Angle potentiometer	Carry out tests at 7-pin cable connector of EDC-VE pump with the help of test adapter KDEP 1160 or KDEP 1165.		
		* Ground connection Connect adapter to cable connector for fuel-injection pump	1 – gr. 2 – gr. 3 – gr.	> 1 M Ω > 1 M Ω > 1 M Ω
		* Short circuit Connect adapter to cable connector for fuel-injection pump	2 – 7	> 1 M Ω
		* Resistance – potentiometer path Connect adapter to cable connector for fuel-inj. pump.	2 – 3	1.0...10.0 k Ω
		* Resistance – slider path Connect adapter to cable connector for fuel-inj. pump.	1 – 3	500 Ω ...5.00 k Ω
		* Supply voltage Connect adapter to cable connector for control unit.	2 – 3 (+) (–)	4.8...5.2 V
		* Voltage signal Connect both cable connectors to adapter. Disconnect cable connectors at temperature sensor 2 (engine) and needle-motion sensor (NMS).	1 – 3	2.0...2.3 V
		Plug in cable connector to NMS.		> 3.0 V

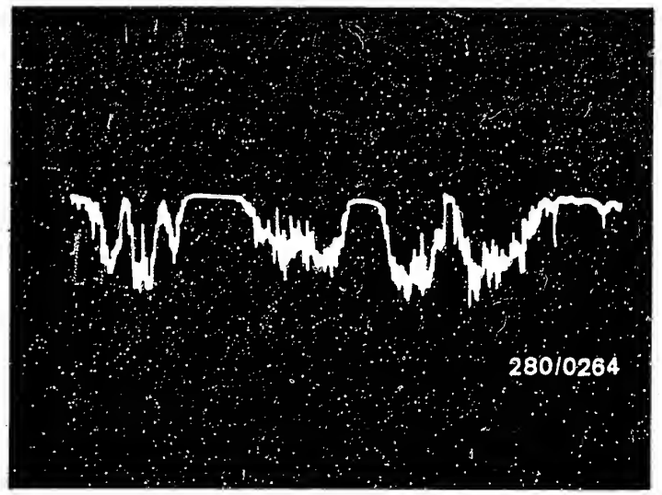
SELF-DIAGNOSIS TEST TABLE (CONTINUED)

Defect-indic. Blink code	Test of component/function	Test instructions/conditions	Terms.	Nominal values
2.3	Quantity control	Carry out testing at 7-pin cable connector for EDC-VE pump with the help of test adapter KDEP 1160 or KDEP 1165.		
		* Ground connection Connect adapter to cable connector for fuel-inj. pump.	4 - gr. 7 - gr.	> 1 M Ω > 1 M Ω
		* Internal resistance Connect adapter to cable connector for fuel-inj. pump.	4 - 7	0.3...1.2 Ω
		* Supply voltage Connect adapter to cable connector for control unit.	3 - 7 (-) (+)	8.0...14.5 V
2.4	Road-speed sensor	Test internal resistance at components at +15...+50°C. Test measuring voltage (control unit) at disconnected cable connector.		240...350 Ω approx. 5 V
2.5	Cruise-control pressure transducer	Test internal resistance at components at approx. +20°C. Test measuring voltage (control unit) at disconnected cable connector.		5.0...6.0 Ω approx. 12 V

SELF-DIAGNOSIS TEST TABLE (CONTINUED)

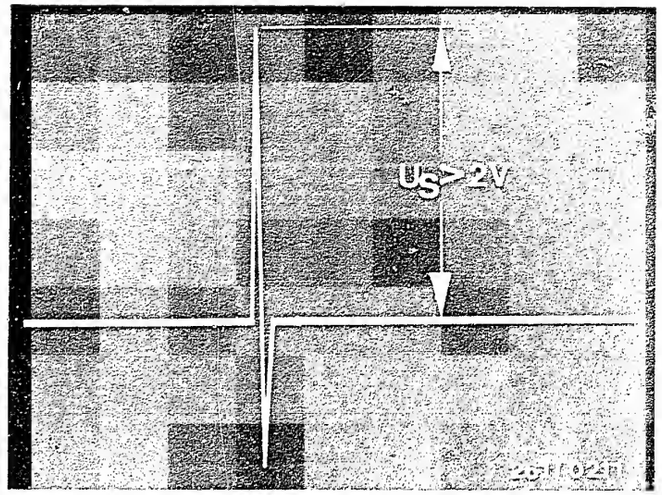
Defect-indic. Blink code	Testing of component/function Test instructions/conditions	Terms.	Nominal values
3.1	Atmospheric-pressure sensor. Carry out testing at component. * Supply voltage * Voltage signal (find out barometric pressure)	 1 – 3 1 – 2	 4.8...5.2 V see characteristic curve
3.3	Air-flow sensor. Carry out testing at component. * Overall resistance * Supply voltage * Voltage signal – By changing the air-flow sensor flap position * Noise test – Motortester, special input	 3 – 4 3 – 4 (+) (–) 2 – 4 2 – 4	 500...1000 Ω 4.8...5.2 V 0.25...4.65 V Noise signal in case of defective air-flow sensor (see illustration)
3.4	Exhaust-gas recirculation press. transd. * Test internal resistance at component at approx. + 20°C. * Test measuring voltage (control unit) at component cable connector * Actuation on-off ratio – Coolant temperature approx. + 80°C – Connect pocket tester to pressure transducer – Set for dwell angle – Operate engine at idle speed – Disconnect cable connector at temperature sensor (coolant) or air-flow sensor. Note for testing: The on-off ratio should change when one of the components is unplugged.		5.0...6.0 Ω approx. 12 V Tester shows the on-off ratio 0...10 %

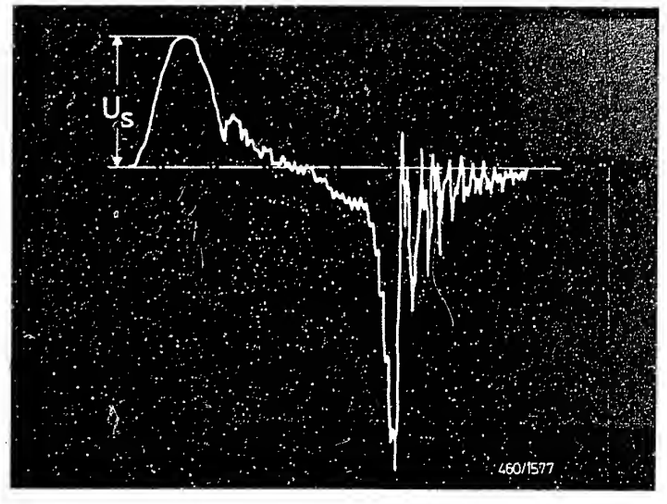




SELF-DIAGNOSIS TEST TABLE (CONTINUED)

Defect-indic. Blink code	Testing of component/function Test instructions/conditions	Terms.	Nominal values
4.1	Engine-speed sensor Carry out tests on component cable connector. * Ground connection * Internal resistance at approx. + 20°C * Engine-speed signal image – Motortester, special input – Operate engine at idle speed Note: Positive signal peak must come first	 1 – 2 (+) (–)	 > 1 M Ω 900...1100 Ω see upper signal image
4.2	Needle-motion sensor – carry out tests on component cable connector. * Ground connection * Internal resistance approx. + 20°C approx. + 80°C * Supply voltage – Cable connector disconnected – Cable connector connected at approx. + 80°C * Valve-lift signal/signal voltage (U_s) – Cable connector connected – Operate engine at idle speed – Motortester special input, or use oscilloscope		 > 1 M Ω 90...110 Ω 111...135 Ω 10.0...12.0 V 2.5... 6.0 V See signal image U_s = > 150 mV





SELF-DIAGNOSIS TEST TABLE (CONTINUED)

Defect-indic. Blink code	Testing of component/function	Test instructions/conditions	Terms.	Nominal values
4.3	Start-of-injection solenoid-operated valve	Carry out testing on component cable connector.		
		* Ground connection		> 1 M Ω
		* Internal resistance at approx. +60°C		13.0...22.0 Ω
		* Test measuring voltage (control unit) at disconnected cable connector.		approx. 12 V
		* Actuation on-off ratio		
		– Coolant temperature approx. + 80°C		
		– Connect pocket tester to connected cable connector		10...30 %
		– Set for dwell angle		
		– Operate engine at idle speed		
		– Unplug cable connector from needle-motion sensor		
		– Plug in cable connector to needle-motion sensor		20...40 %
		Note for testing: The on-off ratio should change when the needle-motion sensor plug is disconnected or when the engine speed increases		
5.1	Computer link, control unit (fault in memory)	Fault not occurring at time of testing. Disconnect control-unit plugs 1 and 2. Test the following leads for open circuits or contact resistance: Control-unit plug 1 — Control-unit plug 2 Term.14 to term.9 Term.15 to term.12		approx. 0 Ω

SELF-DIAGNOSIS TEST TABLE (CONTINUED)

Defect indic. Blink code	Testing of component/function	Test instructions/conditions	Terms.	Nominal values
5.2	Computer linkage, control unit (current fault)	Fault is present at time of testing. Disconnect cable connector at control-unit plugs 1 and 2. Test the following leads for open circuits and/or contact resistance: Control-unit plug 1 — Control-unit plug 22 Term.14 to term.9 Term.15 to term.12		approx. 0 Ω
5.2	Computer monitoring, control unit 1	There is a defect in the computer monitoring only if the engine <u>cannot</u> be started with the indicated blink code. Replace control unit 1.		
Continuous light	Computer monitoring, control unit 2	Self-diagnosis indicator lamp lights up and stays lit, and no blink code is indicated when the test button is pressed. Exhaust-gas recirculation switched off. Disconnect cable connector from start-of-injection solenoid-operated valve. Test measuring voltage (control unit) at cable connector.		approx. 12 V

TEST SPECIFICATIONS

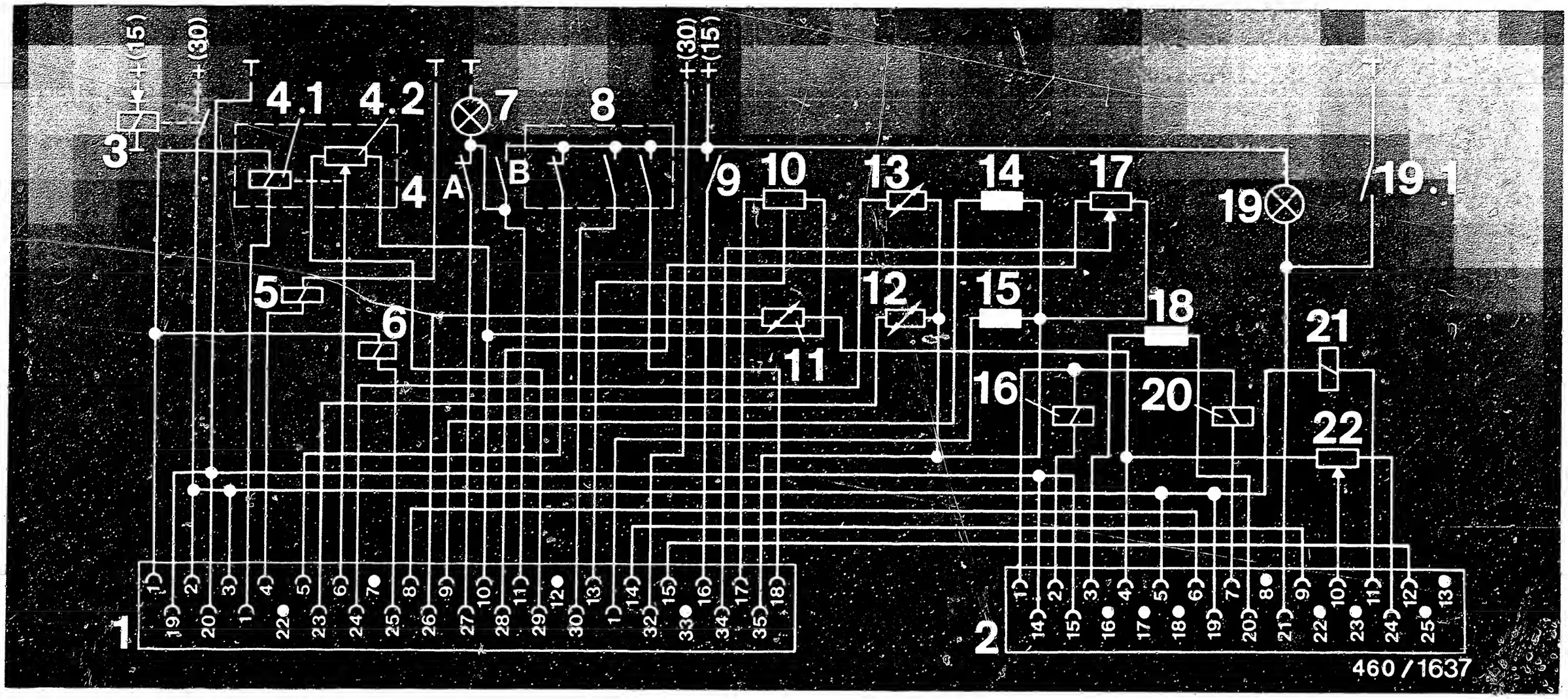
Component/function	Nominal values
Idle speed:	
* Eng. at op. temp. (approx. +80°C)	730... 830 min $^{-1}$
* Engine cold	950...1050 min $^{-1}$
Nozzle-opening pressure:	150 + 8 bar
Coordination of pump and engine:	
Setting value engine position	4th cylinder 1.07 mm before TDC
Inspection value engine position	4th cylinder 1.04...1.10 mm before TDC
Setting value pump position	0.30 mm after BDC
Inspection value pump position	0.28...0.32mm after BDC
Charge-air pressure:	0.8 bar at full load starting at 2000 min $^{-1}$
Compression:	25...30 bar
Max. cylinder deviation	5 bar

TEST SPECIFICATIONS (CONTINUED)

Component/function	Nominal values
Valve clearance – exhaust – intake	0.25...0.30 mm 0.15...0.20 mm
Engine temperature approx. + 20°C	
Filter test, max. allowable differential pressure:	0.3 bar
Pressure drop:	max. perm. 25 %
Transmission-shift valve Internal resistance	28...32 Ω

Tightening torques

Fuel lines	25 Nm
Fastening screws/ fuel-injection pump	20 Nm
Fastening screws/nozzle-holder assemblies	70 Nm
Sheathed-element glow plugs	25 Nm
Screw plug	15 Nm
Adjusting screw – rocker arm	15 Nm
Fastening nut/ crankshaft belt pulley	170 Nm
Cylinder-head cover screws	7.5 Nm



A = Switch, clutch
B = Switch, brakes
1 = Quantity/road-speed control unit (1)
2 = EGR/start-of-injection control unit (2)
3 = Reversed-polarity protection relay
4 = Fuel-injection pump
4.1 = Quantity actuator
4.2 = Actuator potentiometer
5 = ELAB
6 = FGR pressure transducer *
7 = Stop lamps
8 = FGR operating stalk
9 = Air conditioner
10 = Accelerator pedal
11 = Temperature sensor, intake air
12 = Temperature sensor, coolant
13 = Fuel-temperature sensor
14 = Road-speed sensor
15 = Engine-speed sensor
16 = Timing device
17 = Atmospheric-pressure sensor
18 = Needle-motion sensor (NMS)
19 = Diagnostic display
19.1 = Diagnosis request
20 = EGR pressure transducer
21 = transmission-shift valve *
22 = Air-flow sensor

* = only on vehicles with automatic transmission

ELECTRICAL TERMINAL DIAGRAM – EDC

D27 ⟹
D28 ⟸

Trouble-shooting instr. : MB-5026

BOSCH system : Seat-belt feeder system

Make of vehicle : MERCEDES-BENZ

Basic microcard : ————

TABLE OF CONTENTS

SPECIAL FEATURES

This microcard contains the trouble-shooting instructions for the seat-belt feeder system in the following vehicle models:

* MERCEDES-BENZ 380 SEC ... 560 SEC

Type C126 (1981 ->)

The seat-belt feeder system is tested using the heater- and air-conditioner test adapter KDHK 0001.

General important information

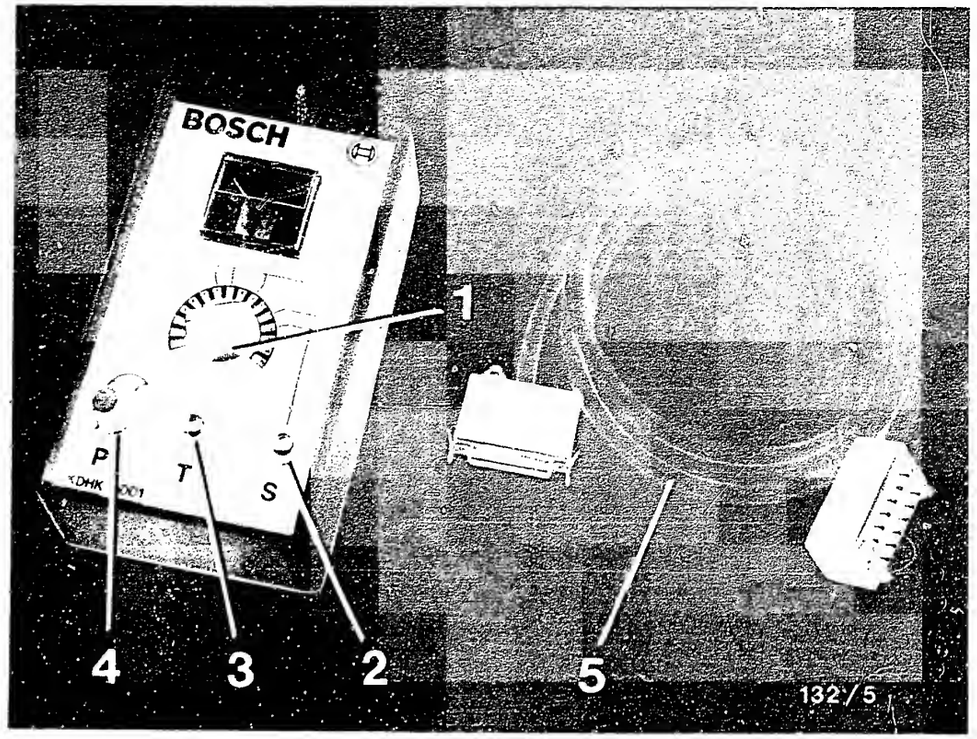
* Overload protection

  If the connecting rod does not move forwards or backwards under its own energy, the seat-belt feeder system switches off completely after approx. 15 s.
  If the connecting rod impacts with an obstacle when moving forwards, the force-limiting switch responds and the connecting rod moves backwards.
  The system likewise switches of completely after the 8th return.

  After eliminating the functional defect, the system can be put into operation again only by open-circuiting the battery voltage.

* Emergency actuation

  The connecting rod can be pushed back into the rest position by hand if the electrical system breaks down.



Test equipment and tools

Heater- and air-conditioner test adapter
KDHK 0001
 1 = Rotary switch (S1)
 2 = Auxiliary switch (S)
 3 = Non-locking switch (T)
 4 = Potentiometer (P)
 5 = Adapter lead KDHK 0013
     (Can be loaned from KH/VSK and KH/VKD)

Multimeter
  e.g. ETE 014.00 0 684 101 400
  or Pontavi Commercially available

For production reasons:
continued on the following
coordinate.

RAPID DIAGNOSIS CHART FOR SEAT-BELT FEEDER SYSTEM

The following rapid diagnosis chart makes it possible for the experienced expert to quickly check the system using the test adapter KDHK 0001.
The contents of this list are limited to the following details:

* Test step sequence
* Switch position at adapter
* Test instructions and test specifications (readings at adapter)
* Instructions for eliminating defects

Test requirement

* Check customer complaints (check operation of seat-belt feeder system in accordance with vehicle owner's manual)
* Electrical system (fuses, battery voltage) O.K.

When disconnecting plug connections, the ignition must be switched off.
Disconnect control-unit plug and connect to adapter lead KDHK 0013.
Connect adapter lead to test adapter KDHK 0001.

Rapid diagnosis chart for seat-belt feeder system (continued)

Test adapter KDHK 0001 with adapter lead KDHK 0013

Test step	Rotary-switch position	Under test	Test instructions	Control-unit plug between terminal	Reading Test specification	Instructions for eliminating defects
1	1	Supply voltage, electr. control unit (term. 30)		2 <=> 8	Greater than 10	Check fuses. Check leads for short circuit and open circuit.
2	2	Switch, door contact	Open door (seat belt latched in belt lock).	11 <=> 2	Greater than 10	Check leads for short circuit and open circuit. Check door switch.
2.1			Close door		Approx. 0	
2.2		Switch, belt lock	Seat belt latched in belt lock (door closed)	4 <=> 2	Approx. 0	Check leads for short circuit and open circuit. Check switch in belt lock.
2.3			Seat belt unlatched in belt lock		Greater than 10	
3	3	Supply voltage (term. 15)	Switch on ignition	10 <=> 8	Greater than 10	Check fuses. Eliminate short circuits and open circuits in the lines.
4	5	Limit switch, connecting rod retracted. Motor, connecting rod adv.	Switch on auxiliary switch (S) at test adapter.	9 <=> 2	Approx. 0	Eliminate short circuits and open circuits in the leads. Check limit switch. Check connecting-rod motor.
4.1			Press minibutton at adapter lead; until indic. larger 10, connecting rod moves from rest position.		Greater than 10	
5	8	Limit switch 25 mm		3 <=> 2	Greater than 10	Eliminate short circuits and open circuits in the leads. Check limit switch.
5.1			Press minibutton at adapter lead, until indic. approx. 0		Approx. 0	

Note: If connecting rod leaves the guideway when advancing: rotary switch (S1) to position 12, switch on auxiliary switch (S) and press minibutton at adapter lead. Insert connecting rod into guideway. Connecting rod is retracted.

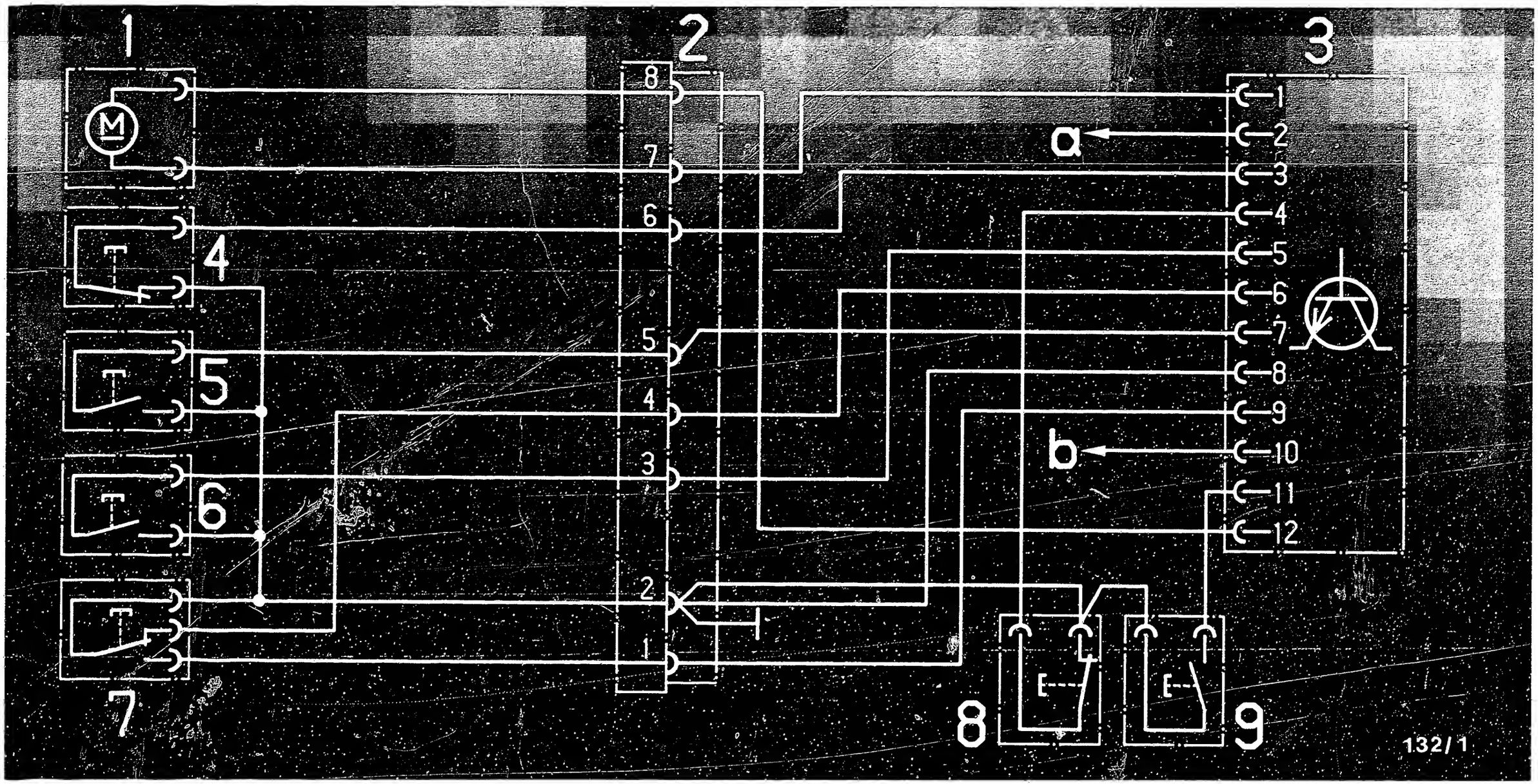
Rapid diagnosis chart for seat-belt feeder system (continued)

Test adapter KDHK 0001 with adapter lead KDHK 0013

Test step	Rotary-switch position	Under test	Test instructions	Control-unit plug between terminal	Reading Test specification	Instructions for eliminating defects
6	10	Limit switch, connecting rod advanced		5 <=> 2	Approx. 0	Eliminate short circuits and open circuits in the leads. Check limit switch.
6.1			Press minibutton at adapter lead until indication greater than 10		Greater than 10	
7	12	Motor, connecting rod (return)	Press minibutton at adapter lead; allow connecting rod to retract fully.	1 <=> 12	Connecting rod retracts	Check fuses. Check leads for short circuit and open circuit. Check connecting-rod motor.
8	13	Limit switch, connecting rod retracted		6 <=> 2	Greater than 10	Check leads for short circuit and open circuit. Check limit switch.
8.1			Press minibutton until indication approx. 0 Set rotary switch (S1) after test to position 12; press minibutton at adapter lead until connecting rod is retracted fully.		Approx. 0	

Switch off ignition, rotary switch (S1) in position 0, disconnect adapter lead, connect control-unit plug to control unit.

9	-	Force-limiting circuit	Switch on ignition; stop connecting rod during advance by hand. (Connecting rod retracts, as soon as it makes contact with an obstacle).		Connecting rod must retract.	Check leads for short circuit and open circuit. Check setting of force-limiting switch.



1 = Motor, seat-belt feeder
2 = Coupling, seat-belt feeder
3 = Control unit, seat-belt feeder system
4 = Limit switch return 25 mm
5 = Force-limiting switch
6 = Limit switch, connecting rod advanced
7 = Limit switch, connecting rod retracted
8 = Switch, belt lock
9 = Switch, door contact
a = Terminal 30
b = Terminal 15

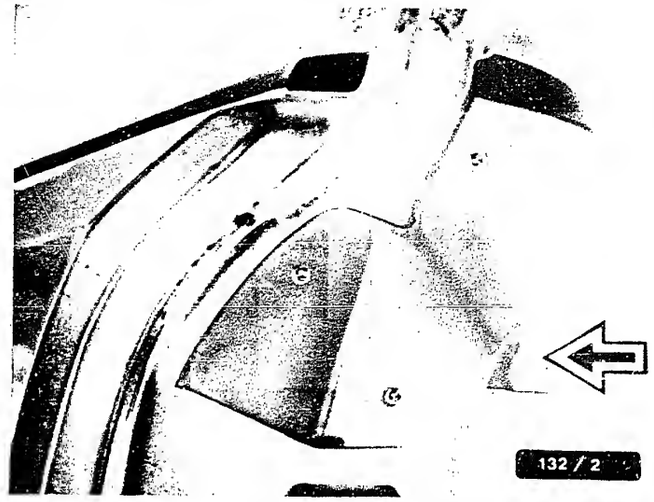
ELECTRICAL TERMINAL DIAGRAM OF SEAT-BELT FEEDER SYSTEM

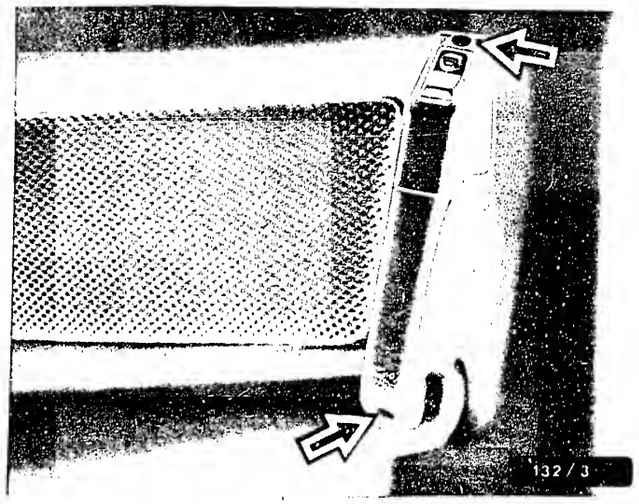
E11 ⟹

E12 ⟸

INSTALLATION POSITION OF COMPONENTS

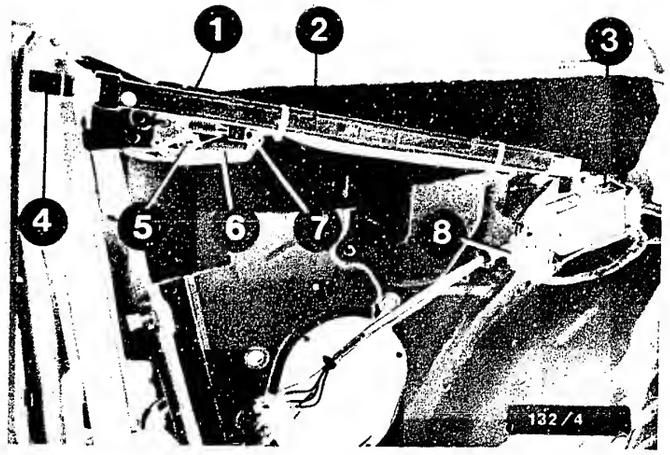
The seat-belt feeder system is installed beneath the rear side panel.
For testing, remove the side panel.
To do this, remove the rear seat bench with backrest.
Unscrew cover plate (upper illustration - arrow) and remove rubber door seals.
Unscrew hand grip (center illustration).
Fastening screws for hand grip are accessible after removal of the window-glass mechanism switch and of the plug (center illustration - arrows).
Loosen bottom fastening screw of side panel and remove side panel.





Components of the seat-belt feeder (lower illustration).

1 = Control unit, seat-belt feeder
2 = Drive motor
3 = Connecting rod
4 = Guideway for connecting rod
5 = Force-limiting switch
6 = Adjusting screw for force limitation
7 = Limit switch for connecting rod
8 = Coupling, seat-belt feeder



Trouble-shooting instructions : AUD - 5000

BOSCH system : LCD - instrument cluster

Vehicle make : AUDI

Basic microcard : AUD - 517

TABLE OF CONTENTS

SPECIAL FEATURES

This microcard contains the trouble-shooting instructions for the LCD instrument cluster in the following vehicle models:

* AUDI Turbo Quattro with K-Jetronic 9.86 ->
147 kW (200 bhp)

* AUDI Turbo Quattro with Motronic, mid 87->
162 kW (220 bhp)

TROUBLE-SHOOTING CHART

Customer complaint (symptoms of trouble)

	1. Instrument cluster does not light up when ignition is switched on	2. Instrument cluster does not light up when light is switched on but does when ignition is switched on	3. All displays remain still longer than 3 seconds after ignition is switched on	4. Tachometer does not function	5. Speedometer does not function	6. Fuel gauge does not function	7. Temperature indicator does not function	8. Consumption indicator does not function	9. No on-board computer display	10. On-board computer gives incorrect readings	11. Display only poorly visible	Cause (component defect)
*												Battery voltage term. 30 or term. 31 not supplied to instrument cluster
	*											Key for display range defective (lead)
*												Supply cable from term. 15 interrupted
*	*	*	*	*	*	*	*	*	*	*		Instrument cluster defective, replace
			*									Engine-speed signal from ignition term. 7 lacking
				*								Travel-pulse transmitter or lead defective
					*							Fuel-level sensor or lead defect.
						*						Temperature sensor or lead defective
		*										Battery voltage too low
							*					Fuel-consumption sensor or lead defective on K-Jetronic
							*	*	*			Motronic signal lacking
							*	*	*			Replace instrument cluster or sensors
										*		Display-brightness regulator or plug defective

F03 ——— ==>

TROUBLE-SHOOTING CHART (CONTINUED)

Customer complaint (symptoms of trouble)

	12. Monitoring lamp for parking brake, oil press., charge indicator, eng. elecs., headlamp indicator does not light up	13. Ind. lamp for turn signals (right, left), rear-window defroster, high beams does not light up	14. Indicator lamp for "charge" always lights up	15. Conv. from mph -> km/h pressed in clock time pos. with reset key 2 seconds, does not function	16. K-Jetronic/Motronic encoding does not function	17. Current consumption does not go to 0 in the on-board computer during overrun cut-off	18. No "E" reserve indication in on-board computer when tank contents < 3.5 liters	19. Clock switchover USA -> Canada does not function	20. No coding indication in tank-calibration mode on display	21. Display-range switchover does not function	22. Automatic display-range switchover does not functon	Cause (component defect)
*	*											Replace instrument cluster or sensor
*	*											Lamps defective, replace
	*											Grnd. connection lacking (in veh.)
*												Connection of term. 15 lacking (in vehicle)
*												Oil-pressure switch defective
		*										Battery charge not OK
	*											Ground connection (inside cluster) lacking
			*									Reset key defective (no ground connection)
*	*	*	*	*	*	*	*	*	*	*	*	Instrument cluster defective (replace)
					*							Fuel consumption sensor or lead defective
					*							No signal for overrun cut-off
								*				Supply lead term. 15 or switch defective

F04 ——— <==

For production reasons:
continued on the following
coordinate.

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01

The following rapid diagnosis chart makes it possible for the experienced specialist to rapidly test the instrument cluster and associated sensors and sensor signals with the test equipment generally found in the workshop. To do this, the universal test adapter is connected with the system adapter cable between the instrument cluster and the vehicle wiring harness.

This list contains the following information:

* Test-step sequence
* Switch or switch position on universal test adapter
* Test instructions and specifications

Requirements for testing

* Check customer complaints.
  (Check function of instrument cluster according to vehicle's operating manual).
* Electrical system (fuses, battery voltage) in good order.

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (CONTINUED)

System adapter cable: KDES 0005

Test step	Switch V	Switch Ω	Terms.	Inspection of component/function	Test instructions/ conditions (all tests to ground)		Nominal values
1	| V	1	21/22	Ground test – vehicle ground to 35-pin plug of vehicle wiring harness	Resistance measurement		approx. 0...10 Ω
2	| V	6	1	Encoding K-Jetronic: Motronic:	Instrument-cluster plug pulled Resistance measurement	K-Jetronic Motronic	Infinite Ω approx. 0...10 Ω
3	| V	7	26	Temperature sensor coolant	Instrument-cluster plug pulled R_{20} = resistance at + 20°C R_{40} = resistance at + 40°C R_{60} = resistance at + 60°C R_{90} = resistance at + 90°C R_{110} = resistance at + 110°C R_{120} = resistance at + 120°C	 R_{20} : R_{40} : R_{60} : R_{90} : R_{110} : R_{120} :	 approx. 1000 Ω approx. 500 Ω approx. 187...247 Ω approx. 75...97 Ω approx. 44...58 Ω approx. 37...45 Ω
4	| V	8	24	Fuel-level sensor R_{empty} R_{full}	Instrument-cluster plug pulled Resistance with tank empty Resistance with tank full		 R_{empty} approx. 283 Ω R_{full} approx. 40 Ω
5	| V	11	28	Fuel-consumption sensor	Instrument-cluster plug connected Resistance measurement		approx. 0...10 Ω
6	| V	20	27	120° temperature switch	Short-circuit Ω sockets on universal test adapter		Temperature display on instrument cluster flashes
7	1	—	19/20	Battery voltage term. 30 at instrument cluster	Voltage measurement		approx. 12 V
8	3	—	15	Voltage at term. 15 on instrument cluster	Voltage measurement, ignition "ON"		approx. 12 V
9	7	—	11/12	Voltage at term. X on instrument cluster	Voltage measurement, ignition "ON"		approx. 12 V

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (CONTINUED)

System adapter cable: KDES 0005

Test step	Switch V	Switch Ω	Terms.	Inspection of component/function	Test instructions/conditions	Nominal values
10	8	—	4	Eng.-spd. pulses to term 7 of ign. trigger box	Start engine, let vehicle idle, measure with multimeter (analog)	1,5...12 V
11	9	—	17	Oil-pressure switch for 0.35 bar opens starting at about 0.30 bar	Engine at idle Voltage rises from 0 V to approx. 12 V.	approx. 12 V
12	10	—	5	Travel-pulse transmitter (gives rectangular volt)	Ignition ON Move vehicle about 1 meter	0-> ap. 5V-> 0V or ap. 5V-> 0V-> ap. 5V
13	11	—	10	Fuel-consumption sensor supply voltage	Voltage measurement Ignition ON	7...8 V
14	12	—	29	Fuel-consumption sensor	Measured value depending on position of consumption sensor at moment Ignition ON	0...8 V
15	13	—	6	Rocker switch for on-board computer	Ignition ON Press rocker left	1,5...2,5 V approx. 0 V
16	14	—	7	Rocker switch for on-board computer	Ignition ON Press rocker right	1,5...2,5 V approx. 0 V
17	15	—	9	Reset key	Ignition ON Press reset key	3,5...4,5 V approx. 0 V
18	16	—	2	Key for display range	Ignition ON Press key for display range (min, max)	0->12 V
19	17	—	25	Brightness control for instrument cluster	Ignition ON, headlamps ON Operate brightness control for instrument cluster	approx. 9...12 V
20	18	—	1	200 bhp K-Jetr./220 bhp Motronic encoding	Engine idling K-Jetronic: Motronic:	0 V 4...5 V

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (CONTINUED)

System adapter cable: KDES 0005

Test step	Switch V	Switch Ω	Terms.	Inspection of component/function	Test instructions/ conditions	Nominal value
21	20	—	3	Consumption signal K-Jetronic or Motronic	Engine at idle — Change with engine running	0 -> 12 V
22	21	—	8	Brightness sensor	Engine at idle Voltage supply, outside brightness sensor	approx. 5 V
23	22	—	30	Brightness sensor	Ignition ON With increasing brightness the voltage also increases	0 -> 5 V

TEST SPECIFICATIONS

Resistance values:

* Temperature sensor (coolant):

+ 20°C:	approx.1000 Ω
+ 40°C:	approx.500 Ω
+ 60°C:	approx.187...247 Ω
+ 90°C:	approx.75...97 Ω
+110°C:	approx.44...58 Ω
+120°C:	approx.37...45 Ω

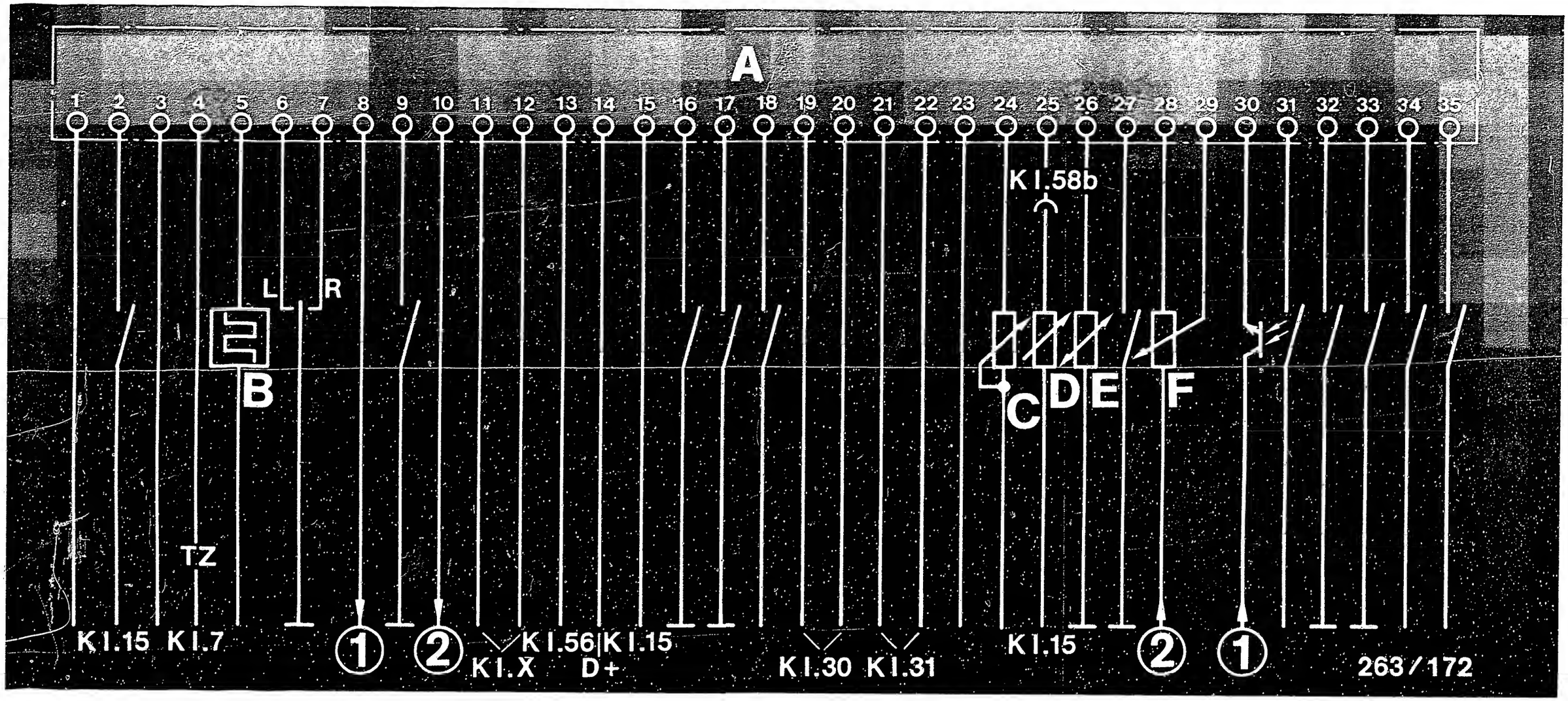
* Fuel-level sensor:

Tank (empty)	approx.283 Ω
Tank (full)	approx.40 Ω

TEST SPECIFICATIONS (CONTINUED)

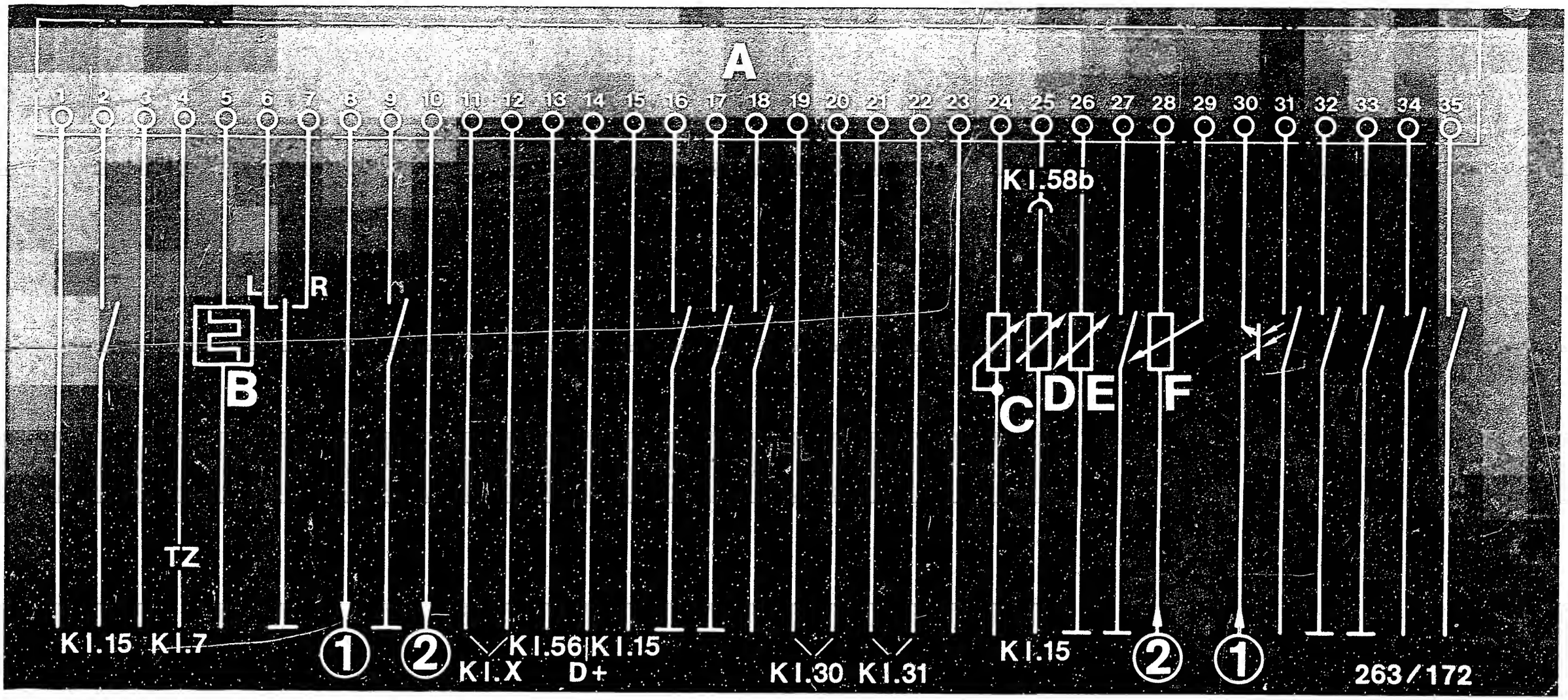
Voltage values:

* Battery voltage:	approx.12 V
* Voltage at term. 15:	approx.12 V
* Voltage at term. X:	approx.12 V
* Voltage at oil-pressure switch at 0.35 bar:	approx.12 V
* Rectangular voltage at travel-pulse transmitter from 0V —> approx. 5V —> 0V or from approx. 5V —> 0V —> 5V	
* Supply voltage of fuel-consumption sensor:	7...8 V
* Fuel-consumption sensor measured value:	0...8 V
* On-board-computer rocker switch:	1,5...2,5->0 V
* Reset key:	3,5...4,5->0 V
* Actuate key for display range:	0->12 V
* Operate brightness control:	approx.9...12 V
* K-Jetronic encoding:	0 V
* Motronic encoding:	4...5 V
* Voltage at brightness sensor:	approx.5 V



INSTRUMENT–CLUSTER ELECTRICAL TERMINAL DIAGRAM (TERMINAL ASSIGNMENT)

A = Instrument cluster
B = Travel sensor
C = Fuel–level sensor
D = Brightness control
E = Temperature sensor
F = Consumption sensor



ELECTRICAL TERMINAL DIAGRAM (CONTINUED)

1 = K-Jet/Motronic encoding
2 = MIN/MAX switch
3 = Consumption K or Motr.
4 = Engine-speed signal
5 = Vehicle speed
6 = On-board computer, left
7 = On-board computer, right
8 = Outside brightness sensor
9 = Reset key for on-board computer
10 = Consumption
11 = Term. X
12 = Term. X
13 = Switch indic. term. 56
14 = Charge mon. term. 61
15 = Term. 15
16 = Brake monitoring
17 = Oil-pressure monitoring
18 = Turn-signal, right
19 = Term. 30
20 = Term. 30
21 = Term. 31
22 = Term.31
23 = Unassigned
24 = Tank
25 = Brightness control
26 = Coolant temperature
27 = 120°C temperature switch
28 = Term. 31
29 = Consumption, K-Jetronic
30 = Outside brightness sensor
31 = High beam
32 = Belt warning
33 = Engine electrics
34 = Turn signal, left
35 = Rear-window defroster

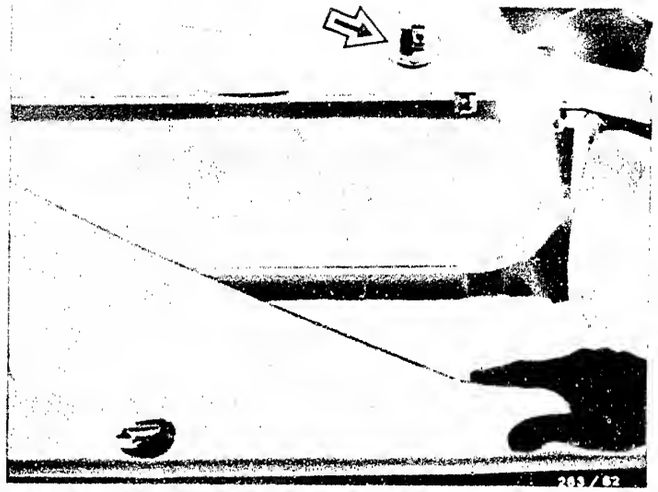
INSTALLATION POSITION OF COMPONENTS

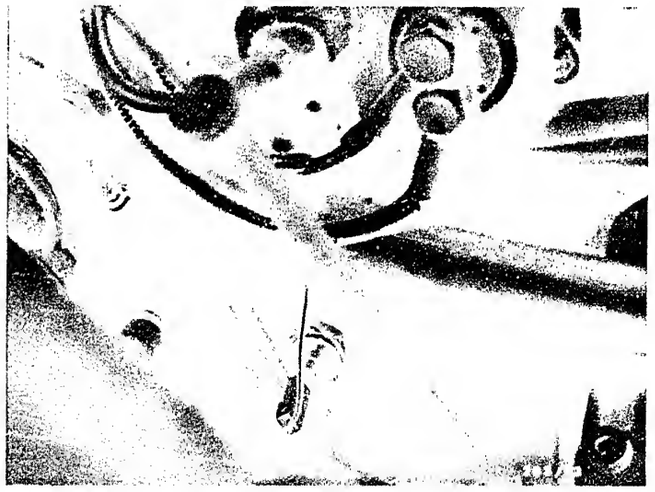
* Electronic instrument cluster: In place of conventional instrument cluster.

* Temperature sensor (coolant): On engine block (upper ill. – arrow).

* Fuel-level sensor: In trunk (center ill. – arrow).

* Oil-pressure switch: Next to oil dipstick (lower ill.)





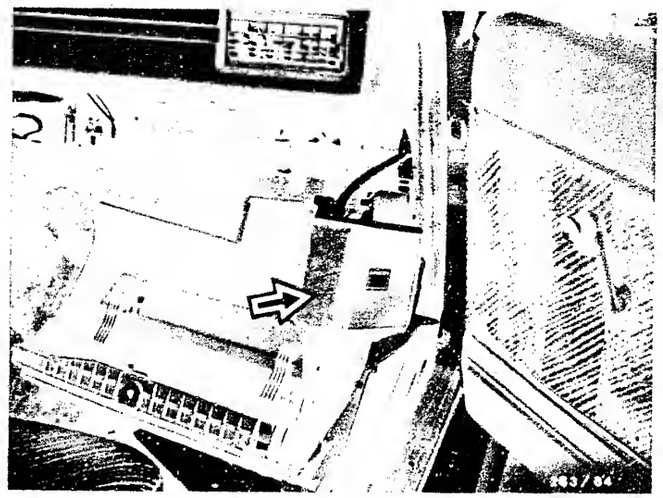
INSTALLATION POSITION OF COMPONENTS (CONTINUED)

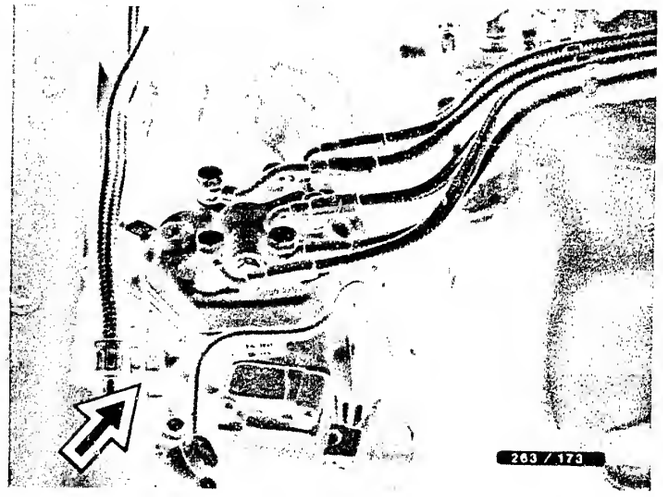
* K-Jetronic control unit: On right next to glove compartment (upper ill. - arrow).

* Travel-pulse transmitter: On front differential, accessible from below vehicle (center ill. - arrow).

* Fuel-consumption sensor: On K-Jetronic air-flow sensor (lower ill. - arrow).

* Battery: Below rear seat.





T A B L E O F C O N T E N T S

Trouble-shooting instructions : MB-5001

BOSCH system : KE 3.1 - Jetronic

Make of vehicle : MERCEDES-BENZ

Basic microcard : PKW-014

Note:
Items without coordinate details are not applicable in these trouble-shooting instructions.

SPECIAL FEATURES

* These instructions contain the trouble-shooting instructions, valid at the time of publication, for the following model:

  MERCEDES-BENZ
  230E, 2,31/4-Zyl.-Mot. 03.85->
  190E 2.3,2,31/4-Zyl.-Mot. 03.86->

* Trouble-shooting with theses instructions may only then take place when the details of the "Summary - Service Information for Vehicles" (KFZ-0..) coincide with those of the vehicle type and with the BOSCH number of the KE-Jetronic control unit installed.

* Control unit using digital techniques, characteristic-map control using microprocessor.

* Multi-functional fuel-management system with a characteristic map for operation with lambda closed-loop control (CAT) and a characteristic map for operation without lambda closed-loop control (ECE). Activation of the characteristic maps by trimming plug with corresponding marking. To set to the fuel grades unleaded regular and unleaded premium, only the ignition trimming plug must be re-connected.

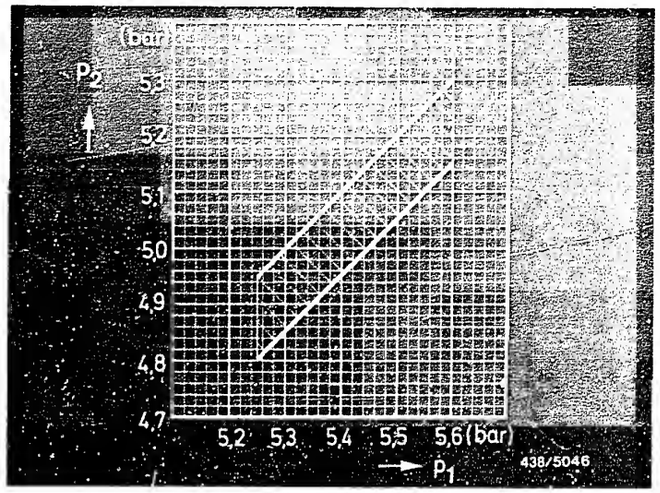
* Electronically controlled idle-speed control with single-winding rotary actuator, without bypass adjusting screw.

* Activated-carbon filter and regeneration valve for return of gasoline vapors into the intake manifold. (Fuel evaporation system)

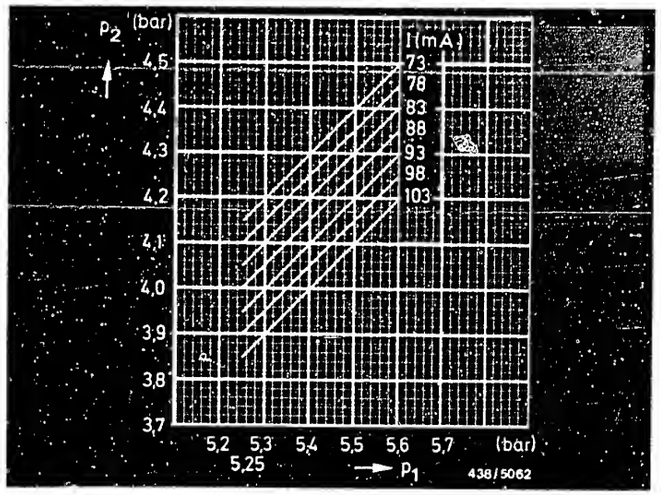
Important note:
If reference is made to a basic microcard, always make certain you use the test specifications from the vehicle-specific brief instructions.

TEST SPECIFICATIONS

No.	Testing/Test condition	Test specification	
1	Electric fuel pump – fuel delivery:	At least 1100 cm ^{3} /min	
2	Primary pressure:	5,25...5,6 bar	
3	Differential pressure: Suppression of peak coil current: Actuate starting motor with fuel-pump relay disconnected. Do not switch off ignition after starting. Take lower-chamber pressure set value "warm" from top chart corresponding to primary pressure measured. (Actuator current 0 mA) Take lower-chamber pressure set value "cold" from bottom chart corresponding to primary pressure measured and actuator current. Tolerance ± 0.15 bar. Simulation of "cold" state: press push-button 3 at test adapter.		
4	Leakage test, complete system: Minimum pressure after 10 mins: Minimum pressure after 20 mins:	 2,7 bar 2,6 bar	
5	Injection valves, opening pressure:	3,0...4,1 bar	
6	Fuel deliveries, comparative measurement: (Actuator current 0 mA)	Setting point: (cm ^{3} /min)	Max. permis. delivery: (cm ^{3} /min)
	Idle: Part load: Full load:	6,0 40,0 100,0	6,6 42,5 109,0
	Min. delivery at max. air-flow sensor plate defl.:	140 cm ^{3} /min	



p_1 = Primary pressure
p_2 = Lower-chamber pressure



G03 ⟹

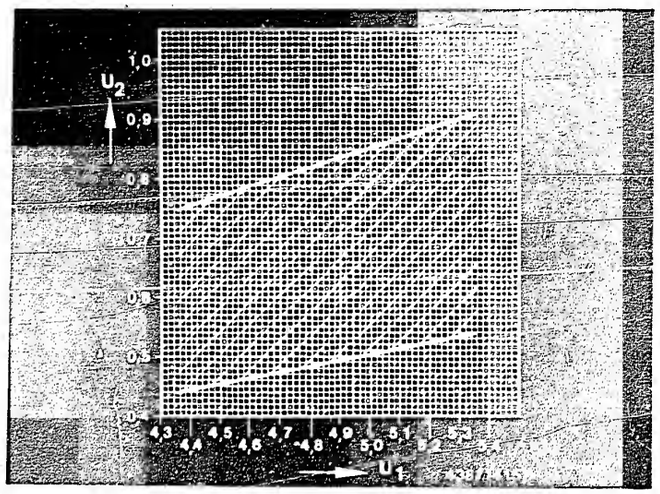
G04 ⟺

TEST SPECIFICATIONS (CONTINUED)

No.	Testing/Test condition	Test specification
7	Rate of flow, KE restriction:	130...150 cm^3 /min
8	Temperature sensor, air (NTC I): Air temperature +15...+30°C:	 1,3...3,6 k Ω
9	Temperature sensor, engine (NTC II): Engine cold (+15...+30°C): Engine warm (approx. +80°C):	 1,3...3,6 k Ω 250...390 Ω
10	Idle-mixture-adjusting screw basic setting: Fuel-distributor seat - needle bearing:	 20,9...21,6 mm
11	Idle adjustment: Low-idle-speed control: adjustment of idle-air delivery not possible. For testing, engine at norm. op. temp. Idle speed: Engage driving position, speed: Engage driving position and switch on air conditioner, speed: <u>Only ECE:</u> CO concentration in exhaust gas: <u>Only CAT:</u> Check lambda closed-loop control: Measurement with lambda closed-loop control tester (e.g. KDJE-P 600) and adapter lead (e.g. KDJE-P 600/52) at diag. socket outlet (pin3). Alternatively: Current measurement using universal test adapter. Put fuel evaporation system out of operation. On-off ratio fluctuating, mean value: Adjustment at idle-mixture-adjusting screw.	 700...800 min^{-1} 620...720 min^{-1} >720 min^{-1} 0,5...1,5 % CO by vol. 45...55 %

TEST SPECIFICATIONS (CONTINUED)

No.	Testing/Test condition	Test specification
12	Signal, air-flow sensor potentiometer: (Checking necessary when poor idle and/or part-load behavior) Measurement using test adapter and voltmeter. Determine supply voltage of potentiometer: Set value (test adapter, V-position 10): Determine potentiometer signal at idle speed. (Test adapter, V-position 11) Set value corresponding to supply voltage: Adjust signal if necessary at trimming potentiometer (at right next to potentiometer pins). Afterwards, re-secure adjusting screw of trimming potentiometer using black sealing compound (e.g Teroson).	 4,35...5,35 V See chart



U_1 = Supply voltage potentiometer

U_2 = Potentiometer voltage signal

SELF-DIAGNOSIS

All Daimler-Benz 4- and 6-cylinder engines in the current series (approx. 10.85) are equipped with self-diagnosis using on-off ratio measurement.

Incorrect input signals from the KE-Jetronic control unit can be displayed with the lambda closed-loop tester at the lambda test output (diagnosis socket, socket 3).

This provides information on short and open circuits. Defects which occur sporadically (e.g. loose contacts) are not indicated. Output of fault signals has priority over output of the lambda closed-loop signal.

We will not go into the defects which can be indicated in more detail here, since the input signals of the KE-Jetronic control unit can be tested with the universal test adapter (rapid-diagnosis chart).

However, if when testing the lambda closed-loop control by means of on-off ratio measurement, a constant on-off ratio is indicated, then the input signals of the KE-Jetronic control unit should be tested (rapid diagnosis chart).

RAPID DIAGNOSIS CHART TO UNIVERSAL TEST ADAPTER ETT 018.01 WITH KE3 ADAPTER LEAD 1 684 463 169 AND APPROPRIATE MULTITESTER:

The following rapid diagnosis chart makes it possible for the experienced Jetronic expert to quickly check the electric/electronic peripheral and control-unit functions of the KE-Jetronic, including the lambda closed-loop control.

Important note on the rapid diagnosis chart:

The "Test conditions" column gives information as to in which test steps the control-unit plug must be connected/disconnected. Make absolutely certain that there is no current at the system when connecting or disconnecting, i.e. the ignition must be switched off and the electric safety circuit must not be short circuited.

The "Test connections" column provides information about the leads connected to the respective measuring path, referring to the assignment in the control-unit plug. Possibly necessary trouble-shooting is with regard to these leads.

The "Test specifications" column contains the test specifications for both the version without lambda closed-loop control (ECE, left-hand test-specifications column) and for the version with lambda closed-loop control (CAT, right-hand test-specifications column). Before starting testing, determine which version is being tested. If only one test specification is given, this applies to both versions.

Attention: When carrying out the test, make sure that the trimming plug is in position 1.

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (CONTINUED)

No.	Switch/Btn V	Ω	Btn	Under test	Test pins	Test conditions	Test specifications
1	| V	4	–	Int. resistance(R_i) pressure actuator	12–10	Disconnect control-unit lead plug.	20...30 Ω
2	| V	5	–	Resistor NTC II (engine)	21– 2	Engine temperature +15°...+30° C: approx. +80° C:	1,3...3,6k Ω 250...390 Ω
3	| V	6	–	Resistor NTC I (intake air)	11– 2	Air temperature in area of NTC I: +15°...+30° C:	1,3...3,6k Ω
4				Signal, altitude sensor		Connect control unit. Switch on ignition. Voltmeter connection to blue Ω sockets. Signal altitude-dependent: 0 meters (sea level): 500 meters: 1000 meters: 1500 meters: 2000 meters: 3000 meters:	Test step not applicable!
5	| V	9	–	Throttle-valve switch, idle	13– 2	Switch off ignition. Disconnect control-unit lead plug. Throttle valve closed: open:	0...10 Ω >1000 Ω
6	| V	10	–	Throttle-valve switch, full load	5– 2	Throttle valve closed: fully open:	>5000 Ω 0...10 Ω
7	| V	11	–	Microswitch idle linkage	24– 2	Throttle valve closed: open:	0...10 Ω infinite Ω
8	| V	12	–	Ground, control unit	20– 2		0...10 Ω
9	| V	13	–	Ground, pin 7	7– 2	Switch off ignition. Connect control unit.	0...10 Ω

RAPID DAIGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (CONTINUED)

No.	Switch/Btn V	Ω	Btn	Under test	Test pins	Test conditions	Test specifications ECE	CAT
10	| V	14	–	Trimming plug mixture map	22– 2	Disconnect control-unit lead plug. Disconnect lead plug from air-flow sensor potentiometer and connect socket 1 of plug (in upper installation position) with engine ground. Trimming-plug position 1: 2: 3: 4: 5: 6: 7:	 50... 60 Ω 100...120 Ω 150...190 Ω 230...270 Ω 330...370 Ω 430...470 Ω 570...620 Ω	 900...1050 Ω 1200...1350 Ω 1500...1750 Ω 2000...2400 Ω 3000...3600 Ω 5000...5600 Ω 11000..12000 Ω
11	| V	15	–	Transmission switch (only automatic transmission)	16– 2	Connect air-flow sensor potentiometer. Selection lever in position P, N: Driving position selected:	 0...10 Ω Infinite Ω	
12	5	–	–	TD signal	25– 2	Start engine (starting motor):	Voltage indefined	
13	6	–	–	Control-unit supply	1– 2	Switch on ignition:	8...15 V	
14	7	–	–	Idle actuator supply and continuity	3– 2	Switch on ignition:	8...15 V	
15	8	–	–	Tempomat signal	6– 2	Switch Tempomat operation:	——— V	
16	9	–	–	Air-conditioner cut-in signal	19– 2	Connect control unit. Start engine, switch on air conditioner. Temperature regulator = minimum temperature:	 8...15 V	
17	10	–	–	Supply, air-flow sensor potentiometer	18– 2	Switch on ignition:	4,35...5,35 V	

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (CONTINUED)

No.	Switch/Btn V	Ω	Btn	Under test	Test pins	Test conditions	Test specificatons ECE	CAT
18	11	–	–	Signal, air–flow sensor potentiometer	17– 2	Switch on ignition. Air–flow sensor plate in neutral position: Deflect air–flow sensor plate by hand, continuous voltage rise up to max.:	0 V 5,35 V	
19	13	–	1	Temperature signal from control unit	9– 2	Switch on ignition. While actuating btn 1:	1,5...1,9 V	
20	14	–	–	Consumption signal	4– 2	Start engine – idle: With regulation:	Voltage indefined Voltage change	
21	–	–	–	Peak coil current	12–12	Switch on ignition:	–>FD 547 : 90...110 mA FD 548–>: 9... 11 mA	–>FD 547 : 90...110 mA FD 548–>: 18... 22 mA
22	–	–	1	Warm–up enrichment +20°C	12–12	Warm up engine – idle. Current value with btn 1 pressed:	–>FD ——— : ——— mA FD 543–>: 12...16 mA	–>FD ——— : ——— mA FD 543–>: 4...8 mA
23	–	24	2	Actuator current Engine at norm. op. temp.	12–12	Eng. at norm. op. temp., idle Current valve with btn 2 pressed: With CAT, oscillating, mean value:	–>FD ——— : ——— mA FD 543–>: –4...+7 mA	–>FD ——— : ——— mA FD 543–>: –1...+1 mA
24	–	21	1	Starting enrichment	12–12	So that eng. fails to start: Disconnect speed relay for elec. fuel pump. Short circuit ign. coil term.4 to grnd via resist. of at least 2k Ω (E.g. with sleeve–type suppressor and spark gap) While btn 1 pressed, actuate starting motor. Current rise (max. 1 s.) to:	–>FD ——— : ——— mA FD 543–>: 50...80 mA	–>FD ——— : ——— mA FD 543–>: 40...70 mA

FD = Date of manufacture

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (CONTINUED)

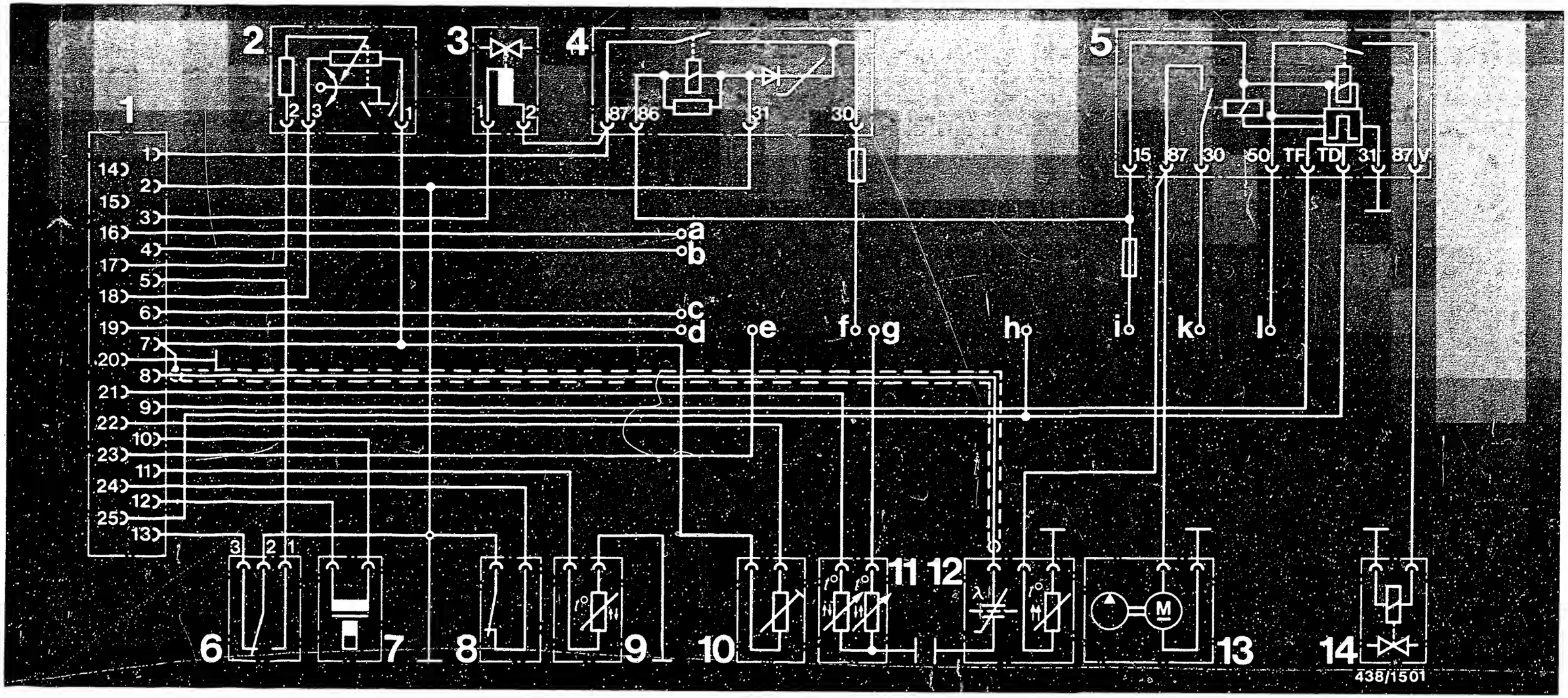
No.	Switch/Btn. V	Ω	Btn.	Subject of testing	Test pins	Test conditions	Test specifications ECE	CAT
25	–	21	1	Post-start enrichment	12-12	Start engine (at normal operating temperature) while operating btn. 1. Current value: Current constant for several seconds, then slow decrease to control level.	->FD ——— : ——— mA FD 543->: 20...30 mA	->FD ——— : ——— mA FD 543->: 10...20 mA
26	–	21	1	Acceleration enrichment	12-12	Engine at operating temp., idling. While pressing btn. 1, sharply accelerate engine. Current increase (approx. 1s) to: Note: The level of current depends on the intensity of acceleration (travel/time of sensor-plate movement).	->FD ——— : ——— mA FD 543->: 30...60 mA	->FD ——— : ——— mA FD 543->: 25...50 mA
27	–	–	–	Overrun cut-off	12-12	Change connections on ammeter (swap pos. and negative). Run vehicle on chassis dynamometer or road. Increase eng. speed n briefly to at least approx.: Current reading during falling engine-speed phase: (throttle-valve switch idle closed)	->FD ——— : ——— min^{-1} FD 543->: 2500 min^{-1} -40...-80 mA	->FD 642 : 4000 min^{-1} FD 643->: 2500 min^{-1} -40...-80 mA

FD = Date of manufacture

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (CONTINUED)

No.	Switch/Btn. V	Ω	Btn.	Subject of testing	Test pins	Test conditions	Test specifications ECE	CAT
28	–	21	–	Full-load enrichment	12-12	Engine at operating temp., idling. Current: Briefly depress accelerator pedal all the way (throttle-valve switch must switch full load). During engine-speed increase, current increase by: Important: Keep this step very brief, to prevent the engine speed from rising too much and damaging the engine.	->FD ——— : ——— mA FD 543->: -4...+7 mA ->FD ——— : ——— mA FD 543->: 2...6 mA	->FD ——— : ——— mA FD 543->: -2...+2 mA ->FD ——— : ——— mA FD 543->: 2...6 mA
29	–	21	–	Lambda closed-loop control, open-loop operation	12-12	Remove regeneration line to throttle-valve assembly at regeneration valve and seal off. Engine at operating temp. at idle. Current:	——	-2...+2 mA
30	–	24	–	Lambda closed-loop control, closed-loop operation	12-12	Engine at operating temp. at idle. Closed-loop operation can be recognized by the oscillating current reading. Mean value: If mean value outside tolerance, set (using idle-mixture-adjusting screw) to:	—— ——	-1...+1 mA approx. 0 mA
31	–	22	–	Lambda closed-loop control rich stop	12-12	Engine at operating temp. at idle. Current rise to:	——	8...12 mA
32	–	23	–	Lambda closed-loop control lean stop	12-12	Engine at operating temp. at idle. Current drop to:	——	-8...-12 mA

FD = Date of manufacture

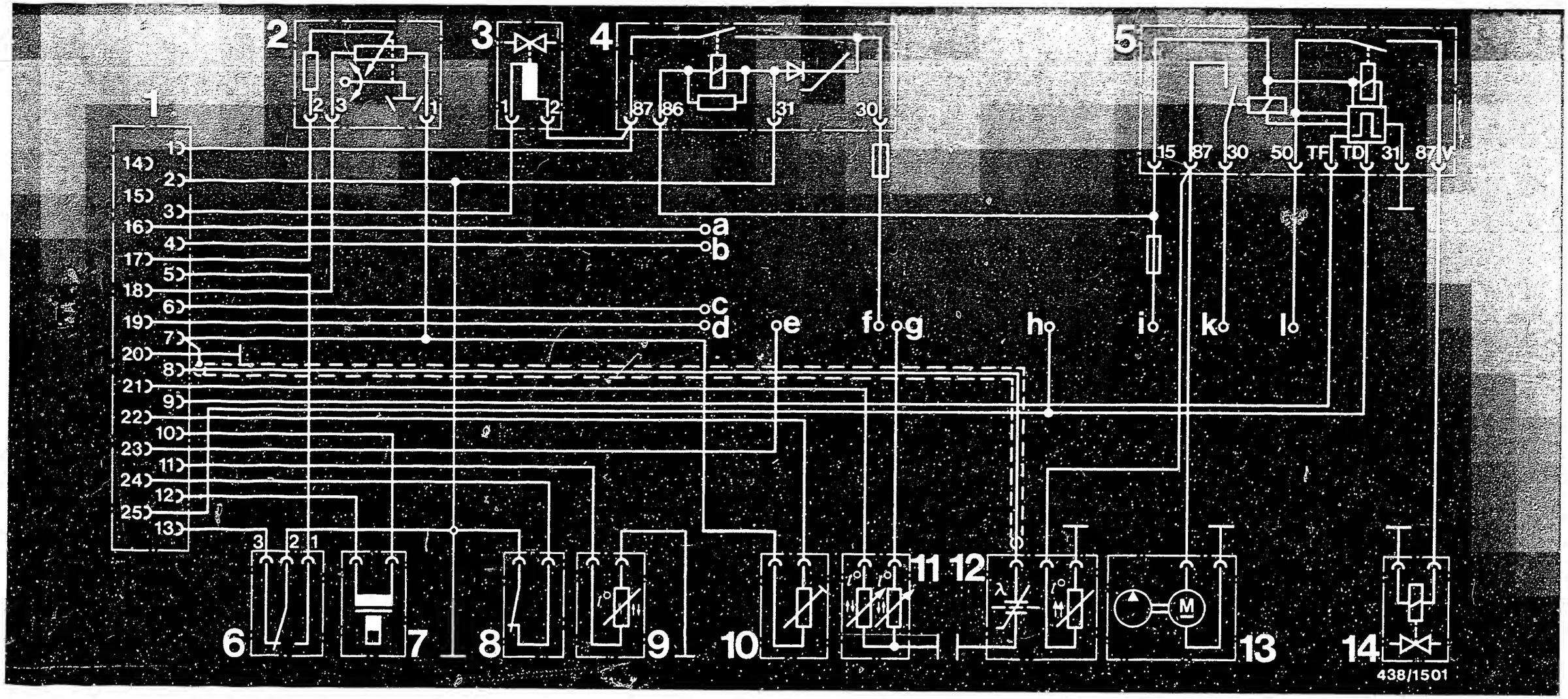


1 = Control-unit, KE-Jetronic
2 = Air-flow sensor potentiometer
3 = Idle actuator
4 = Over-voltage protection relay
5 = Electronic relay for electric fuel pump and cold-start valve actuation
6 = Throttle-valve switch, idle/full load
7 = Electro-hydraulic pressure actuator
8 = Throttle-valve switch, idle/linkage
9 = Temperature sensor, intake air (NTC I)
10 = Trimming plug, map adjustment
11 = Temperature sensor, engine (Double NTC)
12 = Heated lambda sensor
13 = Electric fuel pump
14 = Cold-start valve

ELECTRICAL TERMINAL DIAGRAM WITH ELECTRIC FUEL PUMP SAFETY CIRCUIT

G21 ⟹

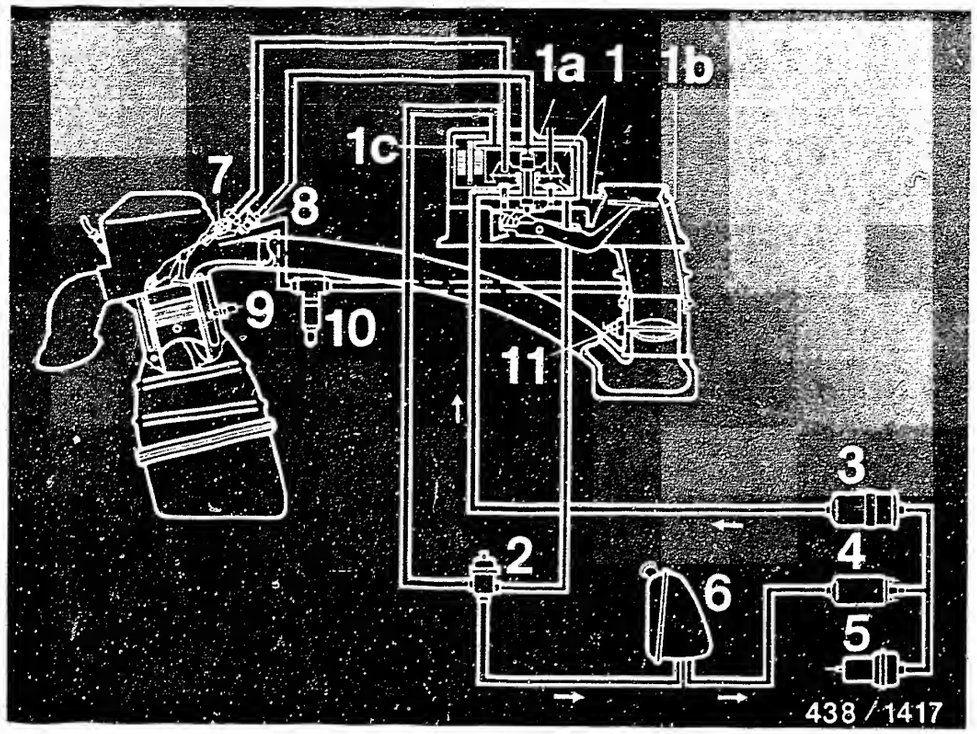
G22 ⟺



a = Transmission switch (automatic only)
b = Consumption signal
c = Connection of Tempomat operating element
d = Connection of air-conditioner control unit
e = Lambda test output

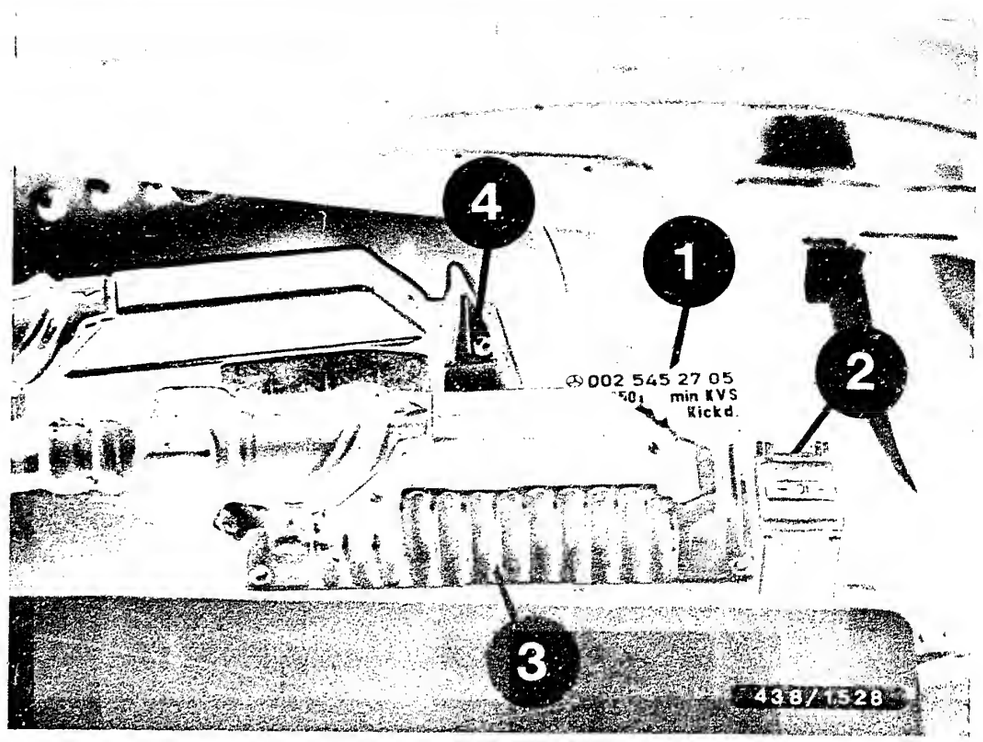
f = Terminal 30 (B +)
g = Ignition system (EZ-L)
h = TD signal, ignition
i = Terminal 15
k = Terminal 30 (B +)
l = Terminal 15a - starting motor

Electrical terminal diagram with electric fuel pump safety circuit (continued)



1 = Mixture-control unit
1a = Fuel distributor
1b = Air-flow sensor
1c = Electro-hydraulic pressure actuator
2 = Pressure regulator, primary pressure
3 = Fuel filter
4 = Electric fuel pump
5 = Fuel accumulator
6 = Fuel tank
7 = Injection valve
8 = Cold-start valve
9 = Temperature sensor engine (Double NTC)
10 = Idle actuator
11 = Throttle-valve switch, idle/full load

DIAGRAM OF AIR AND FUEL LINES



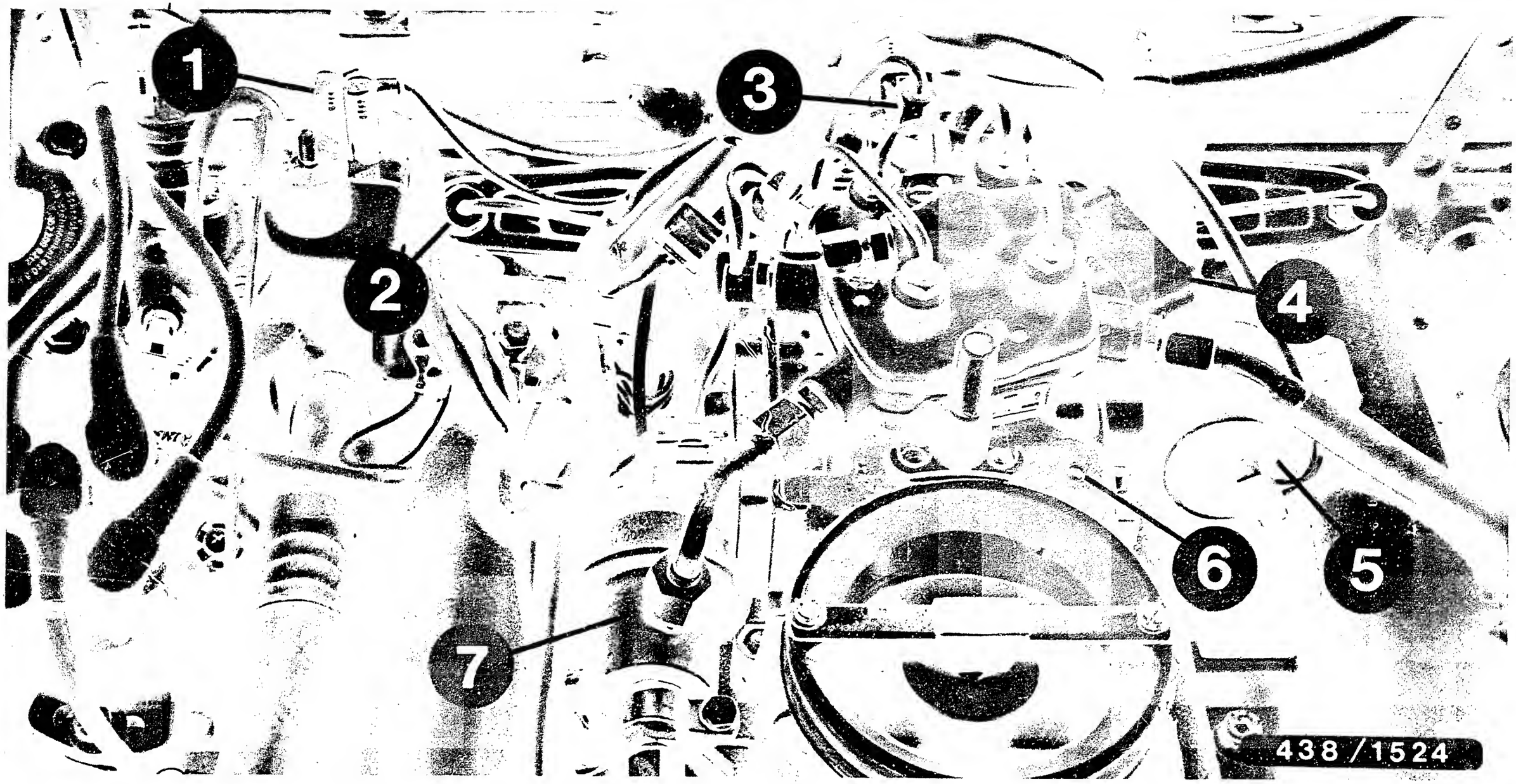
1 = Electronic relay for electric fuel pump and cold-start valve actuation

2 = Over-voltage protection relay

3 = KE-Jetronic control unit

4 = ABS controller (if present)

INSTALLATION POSITION OF COMPONENTS



1 = Engine temperature sensor
2 = Injection valves
3 = Cold-start valve
4 = Pressure actuator
5 = Idle actuator
6 = Mixture-control unit
7 = Pressure regulator

INSTALLATION POSITION OF COMPONENTS

TABLE OF CONTENTS

Trouble-shooting instructions : MB-5003

BOSCH system : KE 3.1 - Jetronic

Make of vehicle : MERCEDES-BENZ

Basic microcard : PKW-014

Note:
Items without coordinate details are not applicable in these trouble-shooting instructions.

SPECIAL FEATURES

* This microcard contains the trouble-shooting instructions, valid at the time of publication, for the following Mercedes-Benz model:

  230 E, TE,2,31/4-Zyl.-Mot.(US/J/AUS) 08.85->
  190 E 2.3 2,31/4-Zyl.-Mot. (US/J/AUS) 08.86->

* Trouble-shooting with these instructions may only then take place when the details of the "Summary - Service Information for Vehicles" (KFZ-000) coincide with those of the vehicle type and with the BOSCH number of the KE-Jetronic control unit installed.

* Control unit using digital techniques, characteristic-map control using microprocessor.

* Electronically controlled low-idle-speed control with single-winding rotary actuator, without bypass adjusting screw.

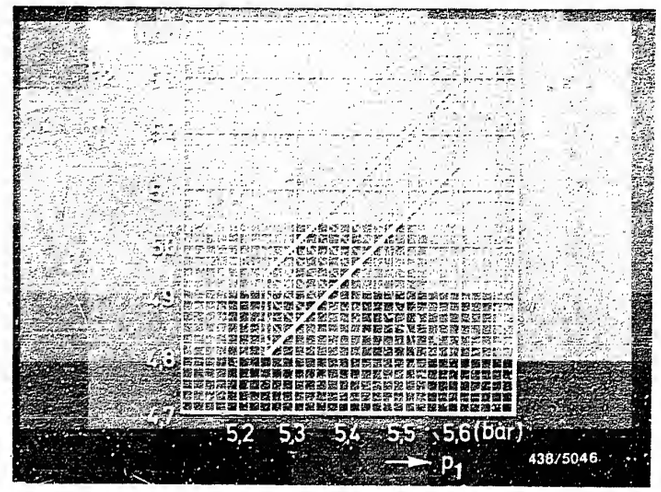
* Activated-carbon filter and regeneration valve for return of gasoline vapors into the intake manifold. (Fuel evaporation system)

Important note:

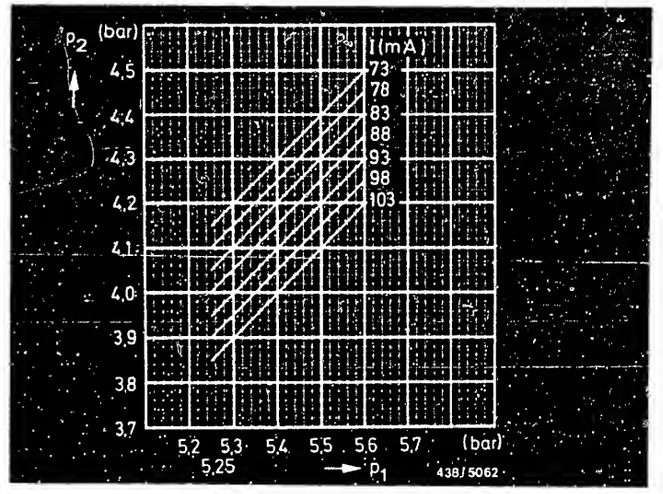
If reference is made to a basic microcard, always make sure you use the test specifications from the vehicle-specific brief instructions.

TEST SPECIFICATIONS

No.	Testing/Test condition	Test specification	
1	Electric fuel pump – fuel delivery:	At least 1100 cm ^{3} /min	
2	Primary pressure:	5,25...5,6 bar	
3	Differential pressure: Suppression of peak coil current: Actuate starting motor with fuel-pump relay disconnected. Do not switch off ignition after starting. Take lower-chamber pressure set value "warm" from top chart corresponding to primary pressure measured. (Actuator current 0 mA) Take lower-chamber pressure set value "cold" from bottom chart corresponding to primary pressure measured and actuator current. Tolerance ± 0.15 bar. Simulation of "cold" state: press push-button 3 at test adapter.		
4	Leakage test, complete system: Minimum pressure after 10 mins: Minimum pressure after 20 mins:	 2,7 bar 2,6 bar	
5	Injection valves, opening pressure:	3,0...4,1 bar	
6	Fuel deliveries, comparative measurement: (Actuator current 0 mA) Idle: Part load: Full load: Min. delivery at max. air-flow sensor plate defl.:	Setting point: (cm ^{3} /min) 6,0 40,0 100,0 140 cm ^{3} /min	Max. permis. delivery: (cm ^{3} /min) 6,6 42,5 109,0



p 1 = Primary pressure
p 2 = Lower-chamber pressure

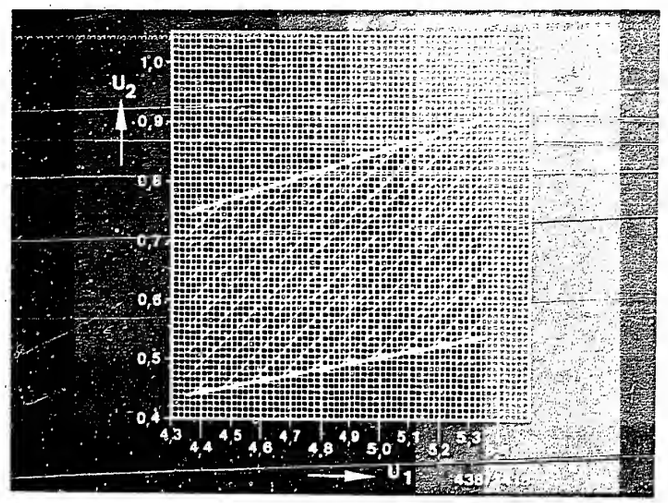


TEST SPECIFICATIONS (CONTINUED)

No.	Testing/Test condition	Test specification
7	Rate of flow, KE restriction:	130...150 cm^3 /min
8	Temperature sensor, air (NTC I): Air temperature +15...+30°C:	 —— k Ω
9	Temperature sensor, engine (NTC II): Engine cold (+15...+30°C): Engine warm (approx. +80°C):	 1,3...3,6 k Ω 250...390 Ω
10	Idle-mixture-adjusting screw basic setting: Fuel-distributor seat - needle bearing:	 20,9...21,6 mm
11	Idle adjustment: Low-idle-speed control: adjustment of idle-air delivery not possible. For testing, engine at norm. op. temp. Idle speed: Engage driving position, speed: Engage driving position and switch on air conditioner, speed: Check lambda closed-loop control: Measurement with lambda closed-loop control tester (e.g. KDJE-P 600) and adapter lead (e.g. KDJE-P 600/52) at diagn. socket outlet (pin3) Alternatively: Current measurement using universal test adapter. Put fuel evaporation system out of operation. On/off ratio fluctuating, mean value: Adjustment at idle-mixture-adjusting screw.	 700...800 min^{-1} 620...720 min^{-1} > 720 min^{-1} 45...55 %

TEST SPECIFICATIONS (CONTINUED)

No.	Testing/Test condition	Test specification
12	Signal, air-flow sensor potentiometer: (Checking necessary when poor idle and/or part-load behavior) Measurement using test adapter and voltmeter. Determine supply voltage of potentiometer: Set value (test adapter, V-position 10): Determine potentiometer signal at idle speed. (Test adapter, V-position 11) Set value corresponding to supply voltage: Adjust signal if necessary at trimming potentiometer (at right next to potentiometer pins). Afterwards, re-secure adjusting screw of trimming potentiometer using black sealing compound (e.g Teroson).	 4,35...5,35 V See chart



U_1 = Supply voltage potentiometer

U_2 = Potentiometer voltage signal

SELF-DIAGNOSIS

All Daimler-Benz 4- and 6-cylinder engines in the current series (approx. 10.85) are equipped with self-diagnosis using on-off ratio measurement.

Incorrect input signals from the KE-Jetronic control unit can be displayed with the lambda closed-loop tester at the lambda test output (diagnosis socket, socket 3).

This provides information on short and open circuits. Defects which occur sporadically (e.g. loose contacts) are not indicated. Output of fault signals has priority over output of the lambda closed-loop signal.

We will not go into the defects which can be indicated in more detail here, since the input signals of the KE-Jetronic control unit can be tested with the universal test adapter (rapid-diagnosis chart).

However, if when testing the lambda closed-loop control by means of on-off ratio measurement, a constant on-off ratio is indicated, then the input signals of the KE-Jetronic control unit should be tested (rapid diagnosis chart).

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 WITH KE3 ADAPTER LEAD 1 684 463 169 AND APPROPRIATE MULTITESTER:

The following rapid diagnosis chart makes it possible for the experienced Jetronic expert to quickly check the electric/electronic peripheral and control-unit functions of the the KE-Jetronic, inlcuding the lambda closed-loop control.

Important note on the rapid diagnosis chart:

The "Test conditions" column gives information as to in which test steps the control-unit plug must be connected/disconnected. Make absolutely certain that there is no current at the system when connecting or disconnecting, i.e. the ignition must be switched off and the electric safety circuit must not be short circuited.

The "Test connections" column provides information about the leads connected to the respective measuring path, referring to the assignment in the control-unit plug. Possibly necessary trouble-shooting is with regard to these leads.

A t t e n t i o n :

When carrying out the test, make sure that the trimming plug is in position 1.

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (CONTINUED)

No.	Switch/Btn V	Ω	Btn	Under test	Test pins	Test conditions	Test specifications
1	V	4	–	Internal resistance (R_i) pressure actuator	12–10	Disconnect control-unit plug.	20...30 Ω
2	V	5	–	Resistance NTC II (engine)	21– 2	Engine temperature +15...+30°C: approx. +80°C:	1,3...3,6 k Ω 250...390 Ω
3				Resistance NTC I (intake air)		Air temperature in area of NTC I = +15...+30°C:	Test step not applicable
4	V	6	–	Signal, altitude sensor	11– 2	Connect control unit. Switch on ignition. Voltmeter connection to blue Ω-sockets. Signal altitude-dependent: 0 meters (sea level): 500 meters: 1000 meters: 1500 meters: 2000 meters: 3000 meters:	 3,2...4,5 V 2,8...4,0 V 2,4...3,5 V 2,0...3,0 V 1,6...2,5 V 0,8...1,6 V
5	V	9	–	Throttle-valve switch, idle	13– 2	Switch off ignition. Disconnect control-unit lead plug. Throttle valve closed: open:	 0...10 Ω > 1000 Ω
6	V	10	–	Throttle-valve switch, full load	5– 2	Throttle valve closed: fully open:	> 5000 Ω 0...10 Ω
7	V	11	–	Microswitch idle linkage	24– 2	Throttle valve closed: open:	0...10 Ω infinite Ω
8	V	12	–	Ground, control unit	20– 2		0...10 Ω
9	V	13	–	Ground, pin 7	7– 2	Switch off ignition. Connect control unit.	0...10 Ω

Rapid diagnosis chart for universal test adapter ETT 018.01 (continued)

No.	Switch/Btn V	Ω	Btn	Under test	Test pins	Test conditions	Test specifications
10	| V	14	–	Trimming plug Mixture map	22– 2	Disconnect control-unit plug. Disconnect lead plug from air-flow sensor potentiometer and connect socket 1 of plug (in upper installation position) to engine ground. Trimming-plug position 1: 2: 3: 4: 5: 6: 7:	 0...10 Ω —— Ω —— Ω —— Ω —— Ω —— Ω —— Ω
11	| V	15	–	Transmission switch (only automatic transmission)	16– 2	Connect air-flow sensor potentiometer. Selection lever position P, N: Driving position selected:	 0...10 Ω infinite Ω
12	5	–	–	TD signal	25– 2	Start engine (starting motor):	Voltage undefined
13	6	–	–	Control-unit supply	1– 2	Switch on ignition:	8...15 V
14	7	–	–	Idle actuator supply and continuity	3– 2	Switch on ignition:	8...15 V
15	8	–	–	Tempomat signal	6– 2	Switch Tempomat operation:	——— V
16	9	–	–	Air-conditioner cut-in signal	19– 2	Switch off ignition. Connect control unit. Start engine, switch on air conditioner. Temperature regulator = Minimum temperature	 8...15 V
17	10	–	–	Supply, air-flow sensor potentiometer	18– 2	Switch on ignition:	4,35...5,35 V

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (CONTINUED)

No.	Switch/Btn V	Ω	Btn	Under test	Test pins	Test conditions	Test specifications
18	11	–	–	Signal, air-flow sensor potentiometer	17– 2	Switch on ignition. Air-flow sensor plate in neutral position: Deflect air-flow sensor plate by hand, continuous rise up to max.:	0 V 5,35 V
19	13	–	1	Temperature signal from control unit	9– 2	Switch on ignition. While actuating btn 1:	 1,5...1,9 V
20	14	–	–	Consumption signal	4– 2	Start engine – idle: With regulation:	Voltage undefined Voltage change
21	–	–	–	Peak coil current	12–12	Switch on ignition:	–>FD 647 : 90...110 mA FD 648–>: 18...22 mA
22	–	21	1	Warm-up enrichment + 20° C	12–12	Warm up engine – idle. Current value with btn 1 pressed:	–>FD —— : ——— mA FD 546–>: 4...8 mA
23	–	24	2	Actuator current engine at normal operating temperature	12–12	Engine at normal operating temperature, idle. Current value with btn 2 pressed; reading oscillating, mean value:	 –>FD —— : ——— mA FD 546–>: –1...+1 mA
24	–	21	2	Starting enrichment	12–12	So that engine fails to start: Disconnect speed relay for electric fuel pump. Short circuit ignition coil term.4 to ground via resistance of at least 2k Ω . (e.g. with sleeve-type suppressor and spark gap) While btn 2 pressed, actuate starting motor. Current rise (max. 1 sec.) to:	 –>FD —— : ——— mA FD 546–>: 40...60 mA

FD = Date of manufacture

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (CONTINUED)

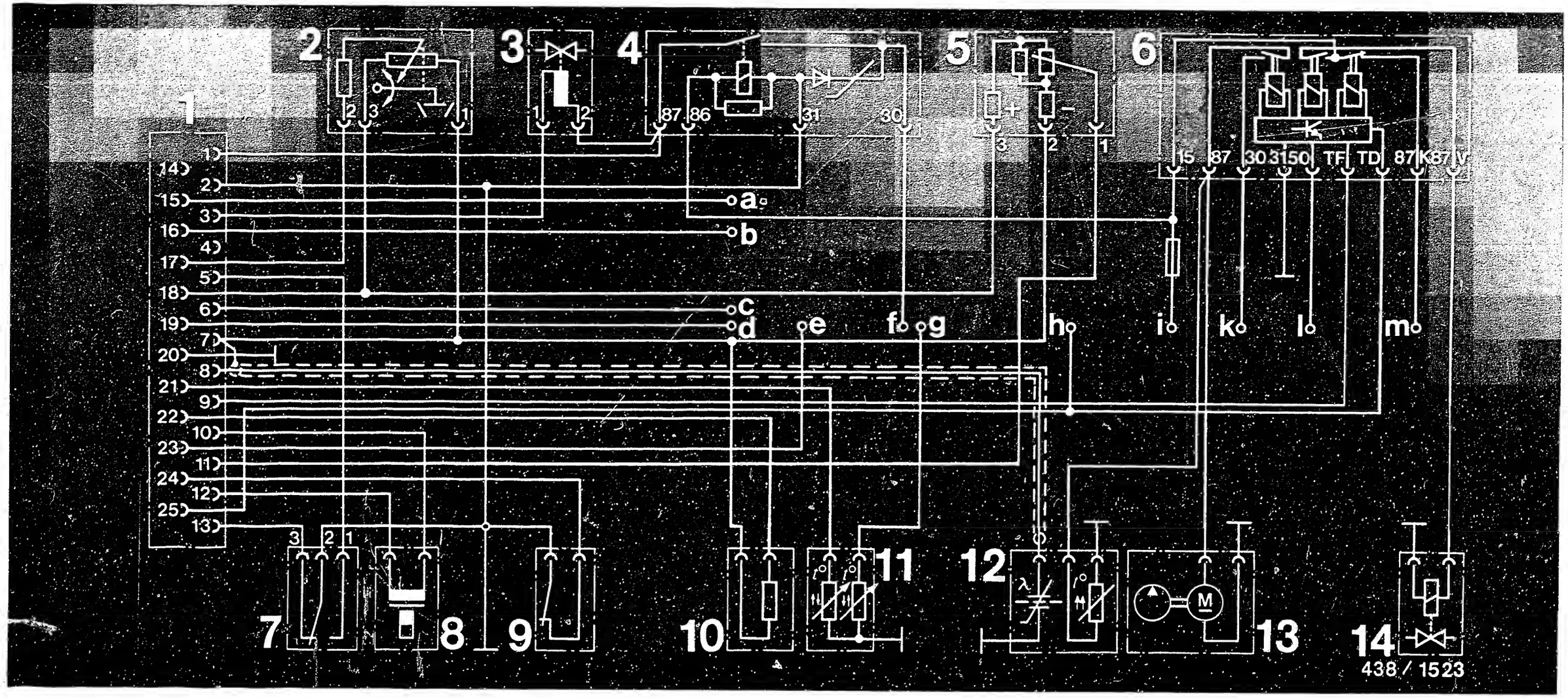
No.	Switch/Btn V	Ω	Btn	Under test	Test pins	Test conditions	Test specifications
25	–	21	1	Post-start enrichment	12–12	Start engine (at normal operating temperature) while actuating btn 1. Current value: Current value constant for a few seconds, then slow speed regulation.	->FD ——— : ——— mA FD 546->: 14...18 mA
26	–	21	1	Acceleration enrichment	12–12	Engine at normal operating temperature, idle. While actuating btn 1, perform snap acceleration of engine. Thus current rise (approx. 1 sec.) to: Note: Level of current value dependent upon intensity of acceleration (travel/duration of air-flow sensor plate movement).	->FD ——— : ——— mA FD 546->: 20...50 mA
27	–	–	–	Overrun cut-off	12–12	Re-connect ohmmeter (swap positive and negative). Start engine (normal operating temperature). Drive vehicle on chassis dynamometer or road. Increase speed n briefly to at least approx.: Current reading during falling speed phase: (idle throttle-valve switch closed)	->FD 551 : 3500 min^{-1} FD 552->: 2000 min^{-1} -40...-80 mA

FD = Date of manufacture

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (CONTINUED)

No.	Switch/Btn V	Ω	Btn	Under test	Test pins	Test conditions	Test specification CAT
28	–	24	–	Full-load enrichment	12-12	Engine at normal operating temperature, idle. Reading oscillating, mean value: Briefly push accelerator pedal to floor (full-load throttle-valve switch must switch). During speed rise, current value rises by: A t t e n t i o n: Do this very briefly, so that speed does not rise too much and engine is not damaged.	 ->FD ——: ——— mA FD 546 ->: -1...+1 mA ->FD ——: ——— mA FD 546 ->: 2...6 mA
29	–	21	–	Lambda closed-loop control, open-loop control mode	12-12	Disconnect regeneration lead to throttle-valve assembly at generation valve and seal. Engine at norm. op. temp., idle. Current value:	 -1...+1 mA
30	–	24	–	Lambda closed-loop control, closed-loop control mode	12-12	Engine at norm. op. temp., idle. Closed-loop control mode can be recognized from the oscillating current reading. Mean value: If mean value outside tolerance, set (idle-mixture-adjusting screw) to approx.:	 -1...+1 mA 0 mA
31	–	22	–	Lambda closed-loop control, rich stop	12-12	Engine at norm. op. temp., idle. Current rise to:	 8...12 mA
32	–	23	–	Lambda closed-loop control, lean stop	12-12	Engine at norm. op. temp., idle. Current drop to:	 -8...-12 mA

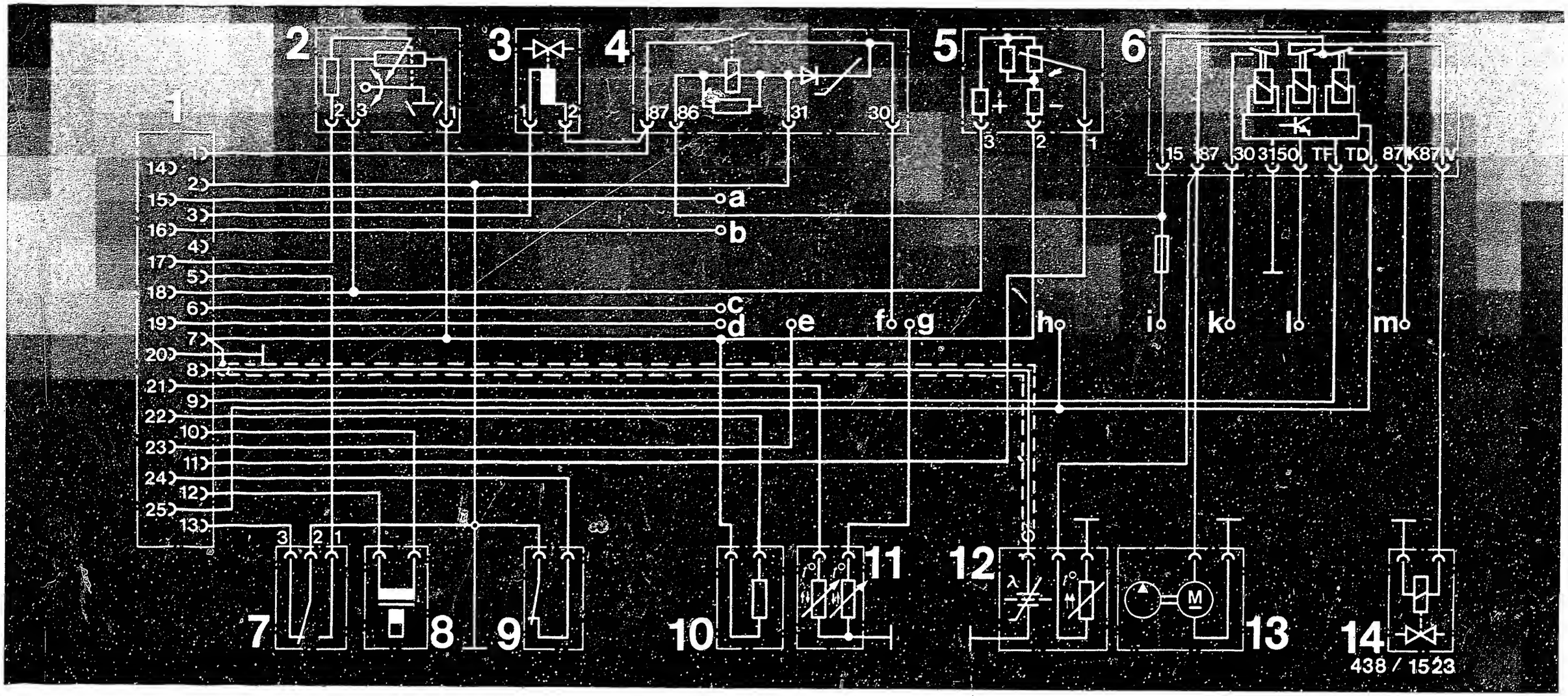
*) FD = Date of manufacture



1 = Control unit, KE-Jetronic
2 = Air-flow sensor potentiometer
3 = Idle actuator
4 = Over-voltage protection relay
5 = Altitude sensor
6 = Electronic relay for electric fuel pump and cold-start valve actuation
7 = Throttle-valve switch, idle/full load
8 = Electro-hydraulic pressure actuator
9 = Throttle-valve switch, idle/linkage
10 = Trimmer resistor, mixture map
11 = Temperature sensor, engine (Double NTC)
12 = Heated lambda sensor
13 = Electric fuel pump
14 = Cold-start valve

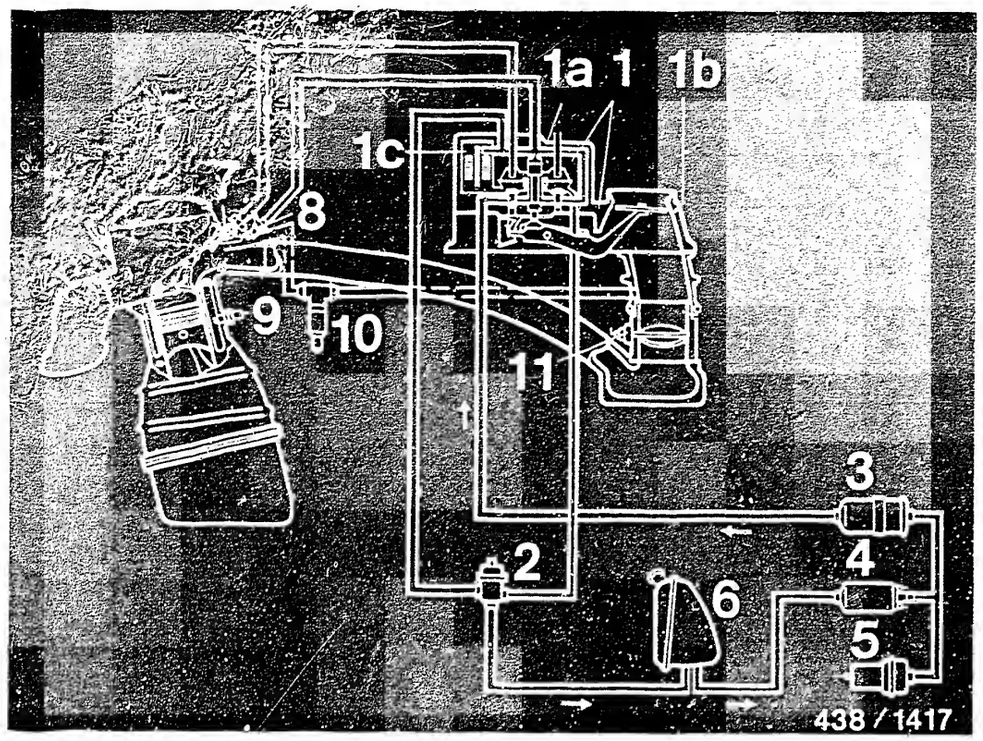
ELECTRICAL TERMINAL DIAGRAM WITH ELECTRIC FUEL PUMP SAFETY CIRCUIT

H21 ⟹
H22 ⟺



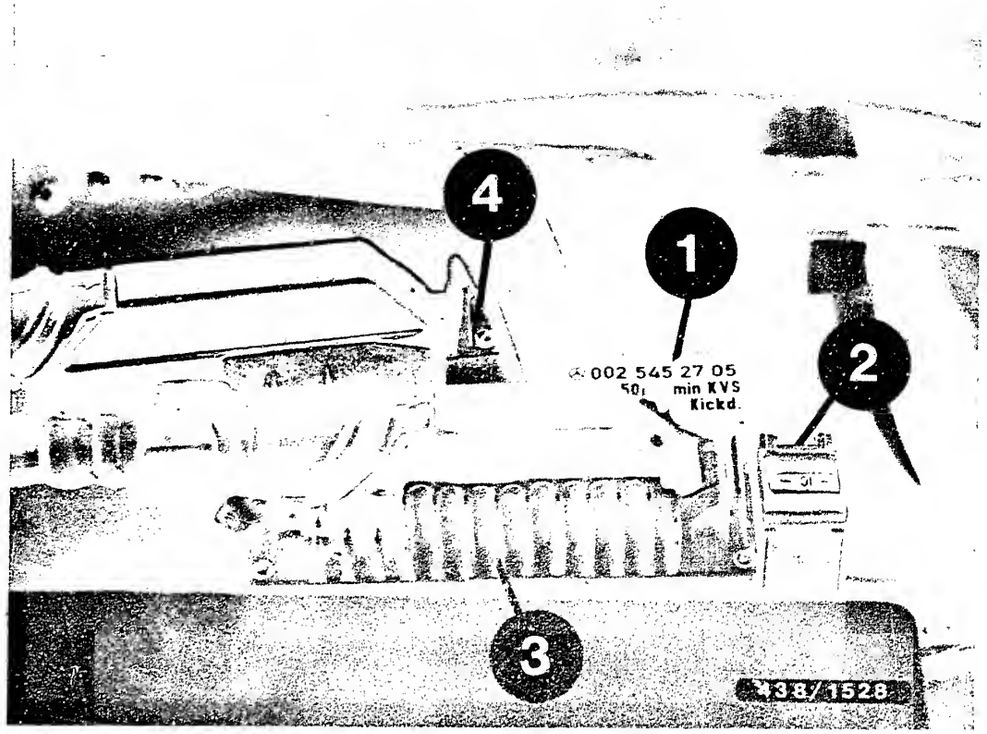
a = Lambda malfunction indicator
b = Transmission switch
c = Connection, Tempomat operating element
d = Connection, air-conditioner control unit
e = Lambda test output (diagnosis socket outlet, socket 3)
f = Terminal 30
g = Ignition system (EI)
h = Terminal TD, ignition
i = Terminal 15
k = Terminal 30
l = Terminal 50
m = Kick-down switch, socket 1

ELECTRICAL TERMINAL DIAGRAM WITH ELECTRIC FUEL PUMP SAFETY CIRCUIT (CONTINUATION)



1 = Mixture-control unit
1a = Fuel distributor
1b = Air-flow sensor
1c = Electro-hydraulic pressure actuator
2 = Pressure regulator, primary pressure
3 = Fuel filter
4 = Electric fuel pump
5 = Fuel accumulator
6 = Fuel tank
7 = Injection valve
8 = Cold-start valve
9 = Temperature sensor engine (Double NTC)
10 = Idle actuator
11 = Throttle-valve switch, idle/full load

DIAGRAM OF AIR AND FUEL LINES



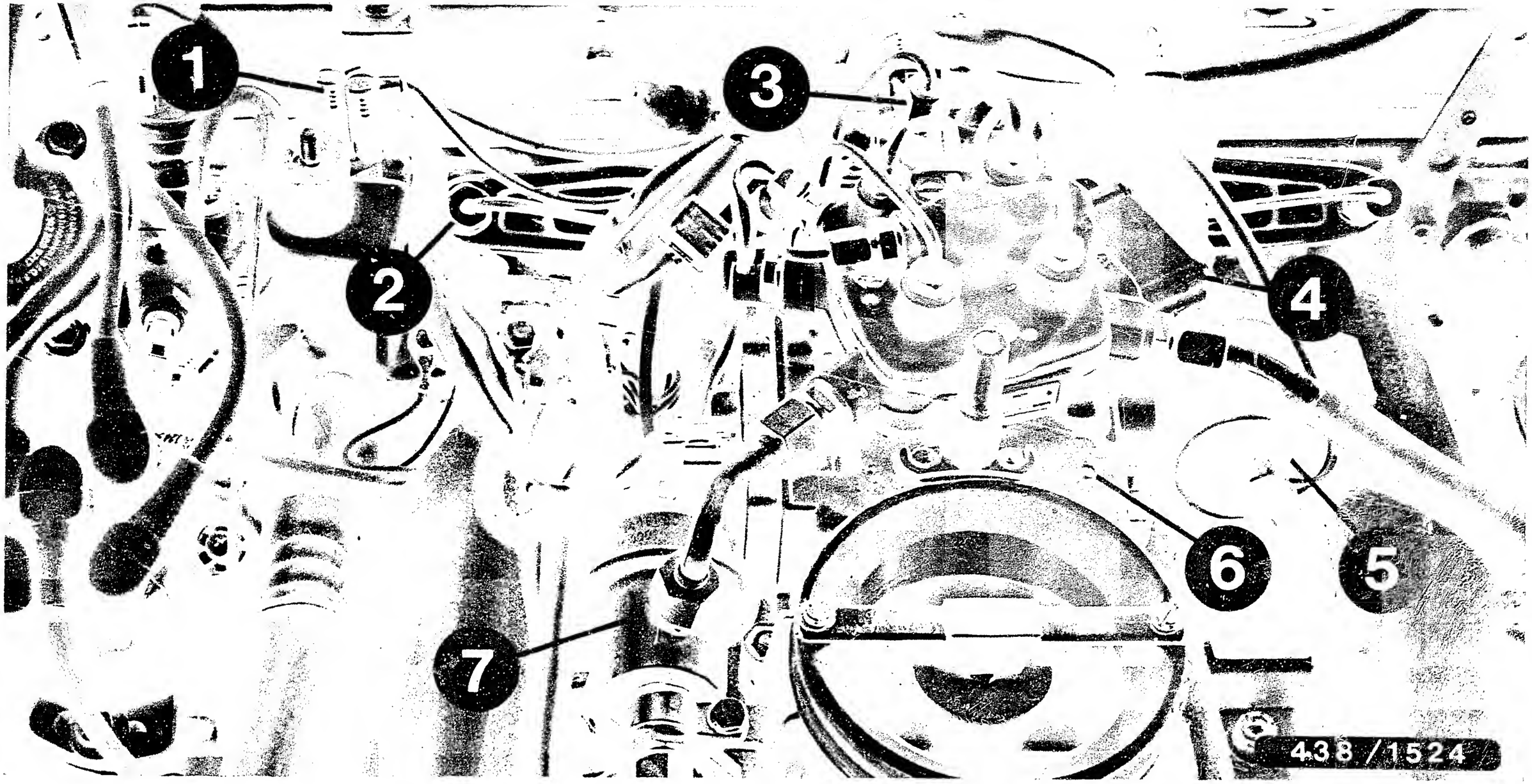
1 = Electronic relay for electric fuel pump and cold-start valve actuation

2 = Over-voltage protection relay

3 = KE-Jetronic control unit

4 = ABS controller (if present)

INSTALLATION POSITION OF COMPONENTS



1 = Engine temperature sensor
2 = Injection valves
3 = Cold-start valve
4 = Pressure actuator
5 = Idle actuator
6 = Mixture-control unit
7 = Pressure regulator

INSTALLATION POSITION OF COMPONENTS

T A B L E O F C O N T E N T S

Trouble-shooting instructions : MB-5004

BOSCH system : KE 3.1 - Jetronic

Make of vehicle : MERCEDES-BENZ

Basic microcard : PKW-014

Note:
Items without coordinate details are not applicable in these trouble-shooting instructions.

SPECIAL FEATURES

* These instructions contain the trouble-shooting instructions, valid at the time of publication, for the following model:

  MERCEDES-BENZ
  190E, 2,01/4-Zyl.-Mot. 07.85->

* Trouble-shooting with theses instructions may only then take place when the details of the "Summary - Service Information for Vehicles" (KFZ-0..) coincide with those of the vehicle type and with the BOSCH number of the KE-Jetronic control unit installed.

* Control unit using digital techniques, characteristic-map control using microprocessor.

* Multi-functional fuel-management system with a characteristic map for operation with lambda closed-loop control (CAT) and a characteristic map for operation without lambda closed-loop control (ECE). Activation of the characteristic maps by trimming plug with corresponding marking. To set to the fuel grades unleaded regular and unleaded premium, only the ignition trimming plug must be re-connected.

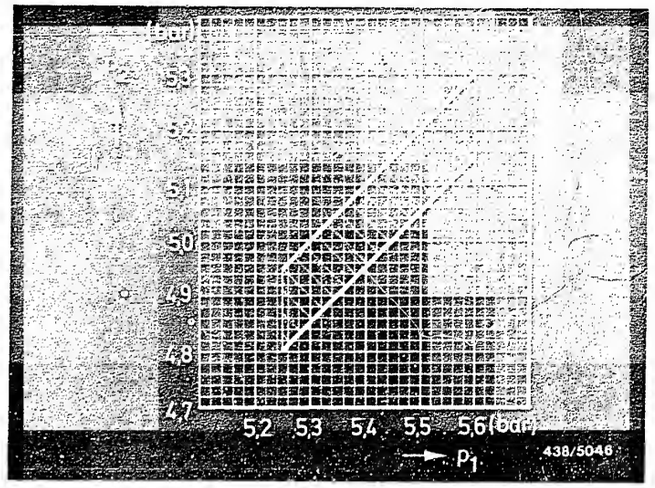
* Electronically controlled idle-speed control with single-winding rotary actuator, without bypass adjusting screw.

* Activated-carbon filter and regeneration valve for return of gasoline vapors into the intake manifold. (Fuel evaporation system)

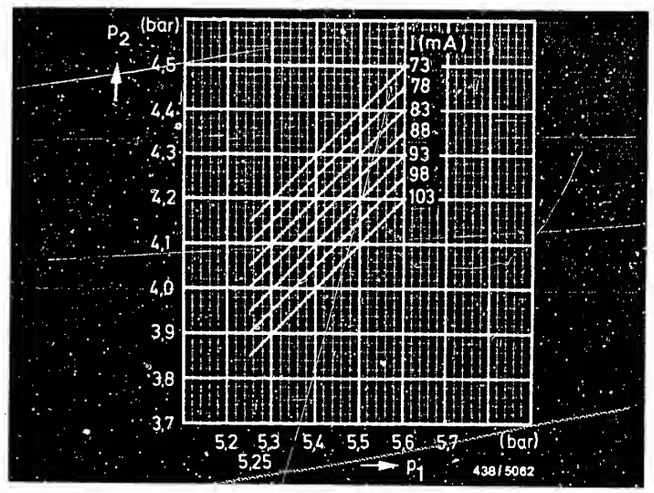
Important note:
If reference is made to a basic microcard, always make certain you use the test specifications from the vehicle-specific brief instructions.

TEST SPECIFICATIONS

No.	Testing/Test condition	Test specification	
1	Electric fuel pump – fuel delivery:	At least 1000 cm ^{3} /min	
2	Primary pressure:	5,25...5,6 bar	
3	Differential pressure: Suppression of peak coil current: Actuate starting motor with fuel-pump relay disconnected. Do not switch off ignition after starting. Take lower-chamber pressure set value "warm" from top chart corresponding to primary pressure measured. (Actuator current 0 mA) Take lower-chamber pressure set value "cold" from bottom chart corresponding to primary pressure measured and actuator current. Tolerance ± 0.15 bar. Simulation of "cold" state: press push-button 3 at test adapter.		
4	Leakage test, complete system: Minimum pressure after 10 mins: Minimum pressure after 20 mins:	 2,7 bar 2,6 bar	
5	Injection valves, opening pressure:	3,0...4,1 bar	
6	Fuel deliveries, comparative measurement: (Actuator current 0 mA)	Setting point: (cm ^{3} /min)	Max. permis. delivery: (cm ^{3} /min)
	Idle: Part load: Full load:	6,0 40,0 100,0	6,6 42,5 109,0
	Min. delivery at max. air-flow sensor plate defl.:	140 cm ^{3} /min	



p 1 = Primary pressure
p 2 = Lower-chamber pressure

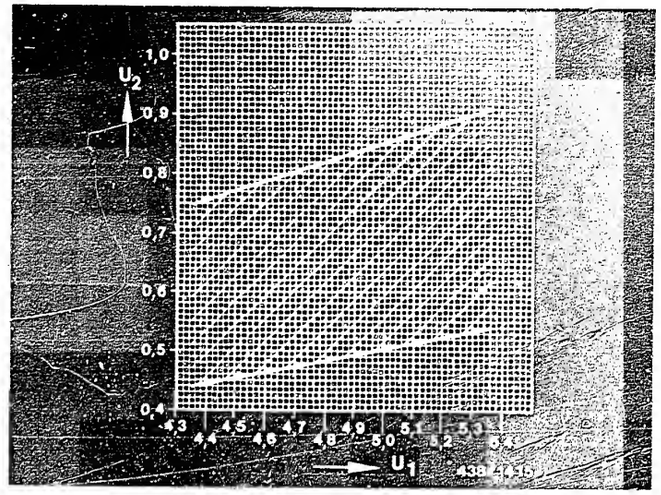


TEST SPECIFICATIONS (CONTINUED)

No.	Testing/Test condition	Test specification
7	Rate of flow, KE restriction:	130...150 cm^3 /min
8	Temperature sensor, air (NTC I): Air temperature +15...+30°C:	 1,3...3,6 k Ω
9	Temperature sensor, engine (NTC II): Engine cold (+15...+30°C): Engine warm (approx. +80°C):	 1,3...3,6 k Ω 250...390 Ω
10	Idle-mixture-adjusting screw basic setting: Fuel-distributor seat - needle bearing:	 20,9...21,6 mm
11	Idle adjustment: Low-idle-speed control: adjustment of idle-air delivery not possible. For testing, engine at norm. op. temp. Idle speed: Engage driving position, speed: Engage driving position and switch on air conditioner, speed: Only ECE: CO concentration in exhaust gas: Only CAT: Check lambda closed-loop control: Measurement with lambda closed-loop control tester (e.g. KDJE-P 600) and adapter lead (e.g. KDJE-P 600/52) at diag. socket outlet (pin3). Alternatively: Current measurement using universal test adapter. Put fuel evaporation system out of operation. On-off ratio fluctuating, mean value: Adjustment at idle-mixture-adjusting screw.	 700...800 min^{-1} 620...720 min^{-1} > 720 min^{-1} 0,5...1,5 % CO by vol. 40...60 %

TEST SPECIFICATIONS (CONTINUED)

No.	Testing/Test condition	Test specification
12	Signal, air-flow sensor potentiometer: (Checking necessary when poor idle and/or part-load behavior) Measurement using test adapter and voltmeter. Determine supply voltage of potentiometer: Set value (test adapter, V-position 10): Determine potentiometer signal at idle speed. (Test adapter, V-position 11) Set value corresponding to supply voltage: Adjust signal if necessary at trimming potentiometer (at right next to potentiometer pins). Afterwards, re-secure adjusting screw of trimming potentiometer using black sealing compound (e.g Teroson).	 4,35...5,35 V See chart



U_1 = Supply voltage potentiometer

U_2 = Potentiometer voltage signal

SELF-DIAGNOSIS

All Daimler-Benz 4- and 6-cylinder engines in the current series (approx. 10.85) are equipped with self-diagnosis using on-off ratio measurement.

Incorrect input signals from the KE-Jetronic control unit can be displayed with the lambda closed-loop tester at the lambda test output (diagnosis socket, socket 3).

This provides information on short and open circuits. Defects which occur sporadically (e.g. loose contacts) are not indicated. Output of fault signals has priority over output of the lambda closed-loop signal.

We will not go into the defects which can be indicated in more detail here, since the input signals of the KE-Jetronic control unit can be tested with the universal test adapter (rapid-diagnosis chart).

However, if when testing the lambda closed-loop control by means of on-off ratio measurement, a constant on-off ratio is indicated, then the input signals of the KE-Jetronic control unit should be tested (rapid diagnosis chart).

RAPID DIAGNOSIS CHART TO UNIVERSAL TEST ADAPTER ETT 018.01 WITH KE3 ADAPTER LEAD 1 684 463 169 AND APPROPRIATE MULTITESTER:

The following rapid diagnosis chart makes it possible for the experienced Jetronic expert to quickly check the electric/electronic peripheral and control-unit functions of the KE-Jetronic, including the lambda closed-loop control.

Important note on the rapid diagnosis chart:

The "Test conditions" column gives information as to in which test steps the control-unit plug must be connected/ disconnected. Make absolutely certain that there is no current at the system when connecting or disconnecting, i.e. the ignition must be switched off and the electric safety circuit must not be short circuited.

The "Test connections" column provides information about the leads connected to the respective measuring path, referring to the assignment in the control-unit plug. Possibly necessary trouble-shooting is with regard to these leads.

The "Test specifications" column contains the test specifications for both the version without lambda closed-loop control (ECE, left-hand test-specifications column) and for the version with lambda closed-loop control (CAT, right-hand test-specifications column). Before starting testing, determine which version is being tested. If only one test specification is given, this applies to both versions.

Attention: When carrying out the test, make sure that the trimming plug is in position 1.

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (CONTINUED)

No.	Switch/Btn V	Ω	Btn	Under test	Test pins	Test conditions	Test specifications
1	| V	4	–	Int. resistance(R_i) pressure actuator	12–10	Disconnect control-unit lead plug.	20...30 Ω
2	| V	5	–	Resistor NTC II (engine)	21– 2	Engine temperature +15°...+30° C: approx. +80° C:	1,3...3,6k Ω 250...390 Ω
3	| V	6	–	Resistor NTC I (intake air)	11– 2	Air temperature in area of NTC I: +15°...+30° C:	1,3...3,6k Ω
4				Signal, altitude sensor		Connect control unit. Switch on ignition. Voltmeter connection to blue Ω sockets. Signal altitude-dependent: 0 meters (sea level): 500 meters: 1000 meters: 1500 meters: 2000 meters: 3000 meters:	Test step not applicable!
5	| V	9	–	Throttle-valve switch, idle	13– 2	Switch off ignition. Disconnect control-unit lead plug. Throttle valve closed: open:	0...10 Ω > 1000 Ω
6	| V	10	–	Throttle-valve switch, full load	5– 2	Throttle valve closed: fully open:	> 5000 Ω 0...10 Ω
7	| V	11	–	Microswitch idle linkage	24– 2	Throttle valve closed: open:	0...10 Ω infinite Ω
8	| V	12	–	Ground, control unit	20– 2		0...10 Ω
9	| V	13	–	Ground, pin 7	7– 2	Switch off ignition. Connect control unit.	0...10 Ω

J11 —— <⟹>

J12 —— <⟹>

RAPID DAIGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (CONTINUED)

No.	Switch/Btn V	Ω	Btn	Under test	Test pins	Test conditions	Test specifications ECE	CAT
10	| V	14	–	Trimming plug mixture map	22– 2	Disconnect control-unit lead plug. Disconnect lead plug from air-flow sensor potentiometer and connect socket 1 of plug (in upper installation position) with engine ground.		
						Trimming-plug position 1:	50... 60 Ω	900...1050 Ω
						2:	100...120 Ω	1200...1350 Ω
						3:	150...190 Ω	1500...1750 Ω
						4:	230...270 Ω	2000...2400 Ω
						5:	330...370 Ω	3000...3600 Ω
						6:	430...470 Ω	5000...5600 Ω
						7:	570...620 Ω	11000..12000 Ω
11	| V	15	–	Transmission switch (only automatic transmission)	16– 2	Connect air-flow sensor potentiometer.		
						Selection lever in position P, N:		0...10 Ω
						Driving position selected:		Infinite Ω
12	5	–	–	TD signal	25– 2	Start engine (starting motor):		Voltage indefined
13	6	–	–	Control-unit supply	1– 2	Switch on ignition:		8...15 V
14	7	–	–	Idle actuator supply and continuity	3– 2	Switch on ignition:		8...15 V
15	8	–	–	Tempomat signal	6– 2	Switch Tempomat operation:		——— V
16	9	–	–	Air-conditioner cut-in signal	19– 2	Connect control unit. Start engine, switch on air conditioner. Temperature regulator = minimum temperature:		8...15 V
17	10	–	–	Supply, air-flow sensor potentiometer	18– 2	Switch on ignition:		4,35...5,35 V

J13 ——— <⟹>

J14 ——— <⟹>

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (CONTINUED)

No.	Switch/Btn V	Ω	Btn	Under test	Test pins	Test conditions	Test specificatons ECE	CAT
18	11	–	–	Signal, air–flow sensor potentiometer	17– 2	Switch on ignition. Air–flow sensor plate in neutral position: Deflect air–flow sensor plate by hand, continuous voltage rise up to max.:	0 V 5,35 V	
19	13	–	1	Temperature signal from control unit	9– 2	Switch on ignition. While actuating btn 1:	1,5...1,9 V	
20	14	–	–	Consumption signal	4– 2	Start engine – idle: With regulation:	Voltage indefined Voltage change	
21	–	–	–	Peak coil current	12–12	Switch on ignition:	–>FD 547 : 90...110 mA FD 548–>: 9... 11 mA	–>FD 547 : 90...110 mA FD 548–>: 18... 22 mA
22	–	–	1	Warm–up enrichment +20°C	12–12	Warm up engine – idle. Current value with btn 1 pressed:	–>FD —— : ——— mA FD 547–>: 12... 16 mA	–>FD 547 : 12... 16 mA FD 548–>: 9... 11 mA
23	–	24	2	Actuator current Engine at norm. op. temp.	12–12	Eng. at norm. op. temp., idle Current valve with btn 2 pressed: With CAT, oscillating, mean value:	–>FD —— : ——— mA FD 547–>: –4...+7 mA	–>FD —— : ——— mA FD 547–>: –1...+1 mA
24	–	21	1	Starting enrichment	12–12	So that eng. fails to start: Disconnect speed relay for elec. fuel pump. Short circuit ign. coil term.4 to grnd via resist. of at least 2k Ω (E.g. with sleeve–type suppressor and spark gap) While btn 1 pressed, actuate starting motor. Current rise (max. 1 s.) to:	–>FD —— : ——— mA FD 547–>: 65...85 mA	–>FD 547 : 65...85 mA FD 548–>: 60...80 mA

FD = Date of manufacture

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (CONTINUED)

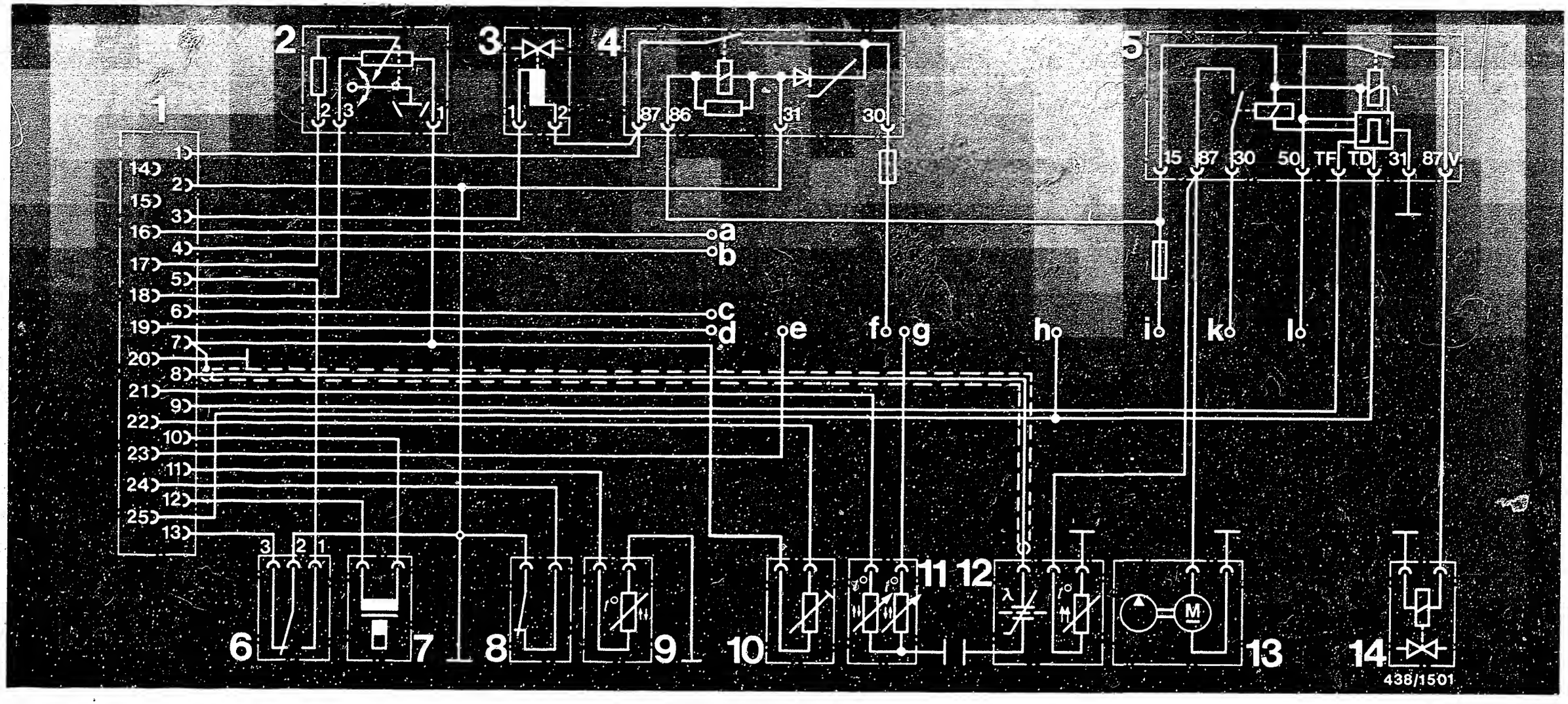
No.	Switch/Btn. V	Ω	Btn.	Subject of testing	Test pins	Test conditions	Test specifications ECE	CAT
25	–	21	1	Post-start enrichment	12-12	Start engine (at normal operating temperature) while operating btn. 1. Current value: Current constant for several seconds, then slow decrease to control level.	->FD —— : ——— mA FD 544->: 22...30 mA	->FD 547 : 22...30 mA FD 548->: 17...24 mA
26	–	21	1	Acceleration enrichment	12-12	Engine at operating temp., idling. While pressing btn. 1, sharply accelerate engine. Current increase (approx. 1s) to: Note: The level of current depends on the intensity of acceleration (travel/time of sensor-plate movement).	->FD —— : ——— mA FD 544->: 30...70 mA	->FD —— : ——— mA FD 544->: 25...65 mA
27	–	–	–	Overrun cut-off	12-12	Change connections on ammeter (swap pos. and negative). Run vehicle on chassis dynamometer or road. Increase eng. speed n briefly to at least approx.: Current reading during falling engine-speed phase: (throttle-valve switch idle closed)	->FD —— : ——— min^{-1} FD 544->: 2500 min^{-1} -40...-80 mA	->FD —— : ——— min^{-1} FD 544->: 2500 min^{-1} -40...-80 mA

FD = Date of manufacture

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (CONTINUED)

No.	Switch/Btn. V	Ω	Btn.	Subject of testing	Test pins	Test conditions	Test specifications ECE	CAT
28	–	21	–	Full-load enrichment	12-12	Engine at operating temp., idling. Current: Briefly depress accelerator pedal all the way (throttle-valve switch must switch full load). During engine-speed increase, current increase by: Important: Keep this step very brief, to prevent the engine speed from rising too much and damaging the engine.	->FD —— : ——— mA FD 544->: -4...+7 mA ->FD —— : ——— mA FD 544->: 1...6 mA	->FD —— : ——— mA FD 544->: -1...+1 mA ->FD —— : ——— mA FD 544->: 1...6 mA
29	–	21	–	Lambda closed-loop control, open-loop operation	12-12	Remove regeneration line to throttle-valve assembly at regeneration valve and seal off. Engine at operating temp. at idle. Current:	——	-1...+1 mA
30	–	24	–	Lambda closed-loop control, closed-loop operation	12-12	Engine at operating temp. at idle. Closed-loop operation can be recognized by the oscillating current reading. Mean value: If mean value outside tolerance, set (using idle-mixture-adjusting screw) to:	—— ——	-1...+1 mA approx. 0 mA
31	–	22	–	Lambda closed-loop control rich stop	12-12	Engine at operating temp. at idle. Current rise to:	——	8...12 mA
32	–	23	–	Lambda closed-loop control lean stop	12-12	Engine at operating temp. at idle. Current drop to:	——	-8...-12 mA

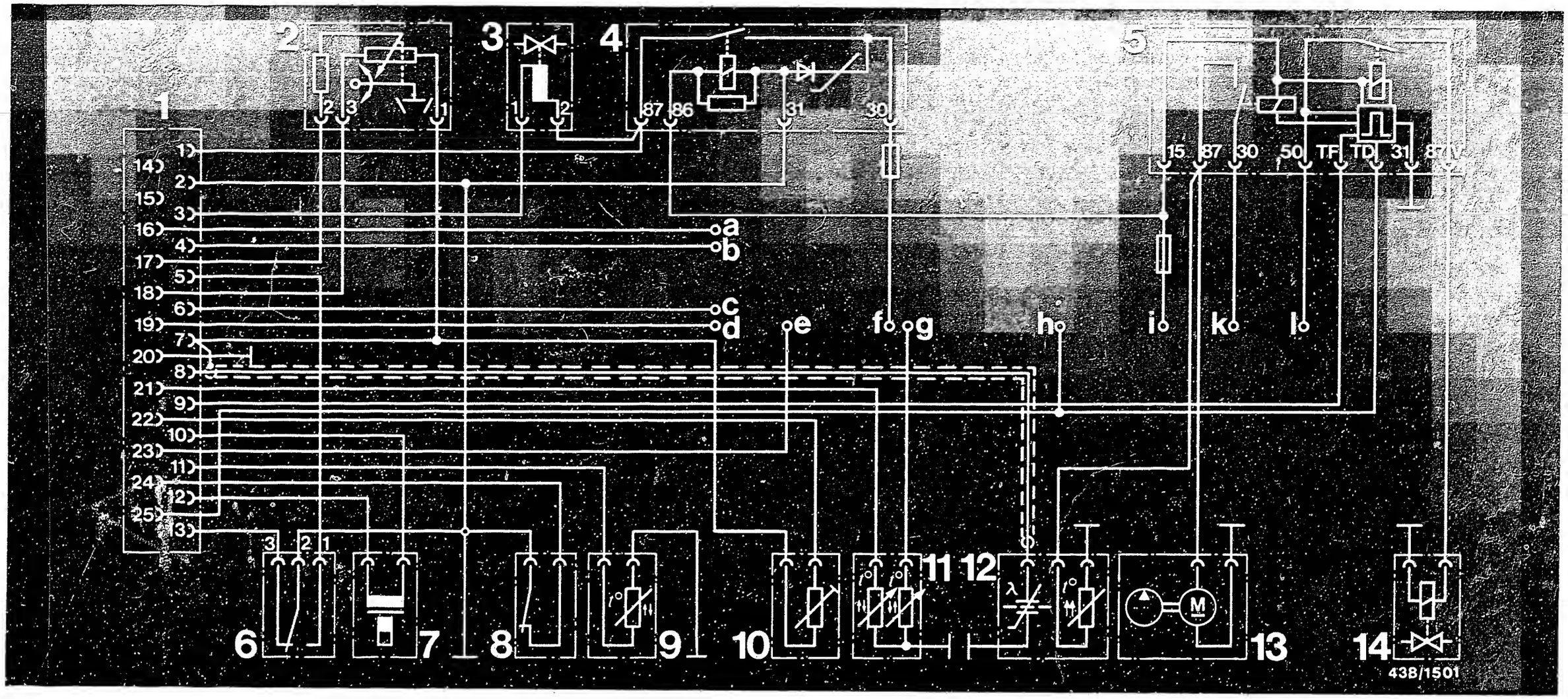
FD = Date of manufacture



1 = Control-unit, KE-Jetronic
2 = Air-flow sensor potentiometer
3 = Idle actuator
4 = Over-voltage protection relay
5 = Electronic relay for electric fuel pump and cold-start valve actuation
6 = Throttle-valve switch, idle/full load
7 = Electro-hydraulic pressure actuator
8 = Throttle-valve switch, idle/linkage
9 = Temperature sensor, intake air (NTC I)
10 = Trimming plug, map adjustment
11 = Temperature sensor, engine (Double NTC)
12 = Heated lambda sensor
13 = Electric fuel pump
14 = Cold-start valve

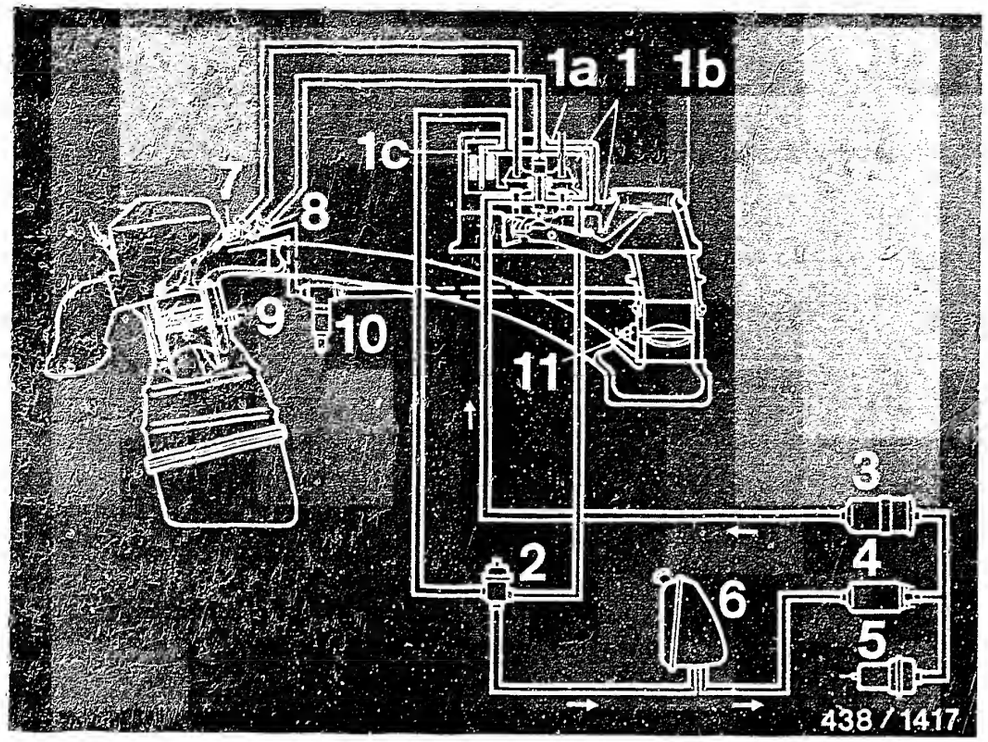
ELECTRICAL TERMINAL DIAGRAM WITH ELECTRIC FUEL PUMP SAFETY CIRCUIT

J21 ⟹
J22 ⟺



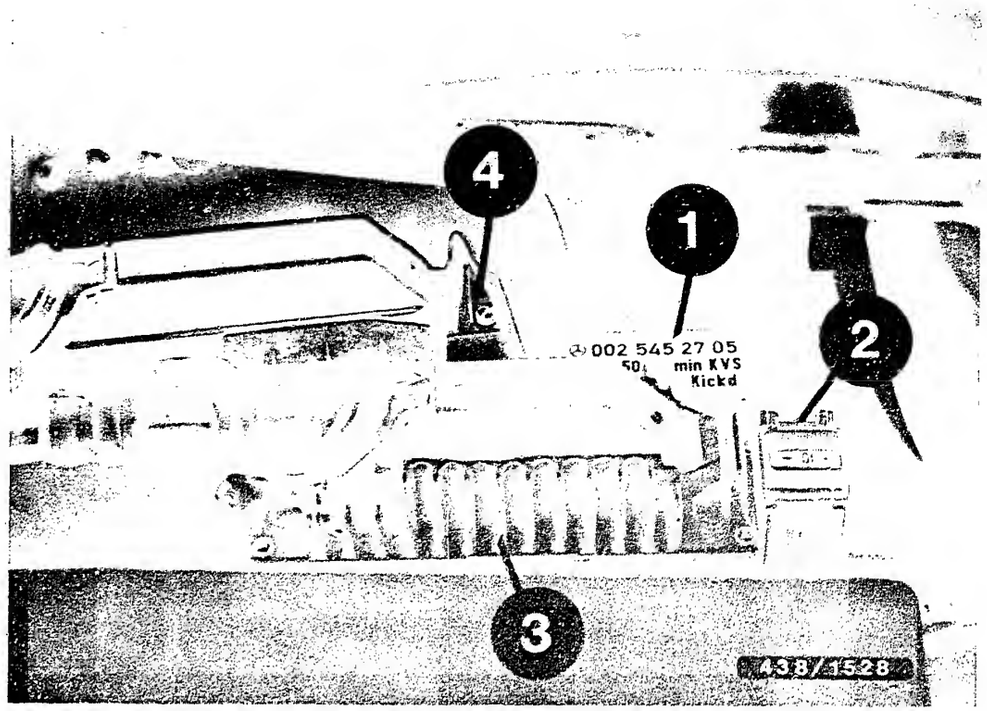
a = Transmission switch (automatic only)
b = Consumption signal
c = Connection of Tempomat operating element
d = Connection of air-conditioner control unit
e = Lambda test output
f = Terminal 30 (B +)
g = Ignition system (EZ-L)
h = TD signal, ignition
i = Terminal 15
k = Terminal 30 (B +)
l = Terminal 15a – starting motor

Electrical terminal diagram with electric fuel pump safety circuit (continued)



1 = Mixture-control unit
1a = Fuel distributor
1b = Air-flow sensor
1c = Electro-hydraulic pressure actuator
2 = Pressure regulator, primary pressure
3 = Fuel filter
4 = Electric fuel pump
5 = Fuel accumulator
6 = Fuel tank
7 = Injection valve
8 = Cold-start valve
9 = Temperature sensor engine (Double NTC)
10 = Idle actuator
11 = Throttle-valve switch, idle/full load

DIAGRAM OF AIR AND FUEL LINES



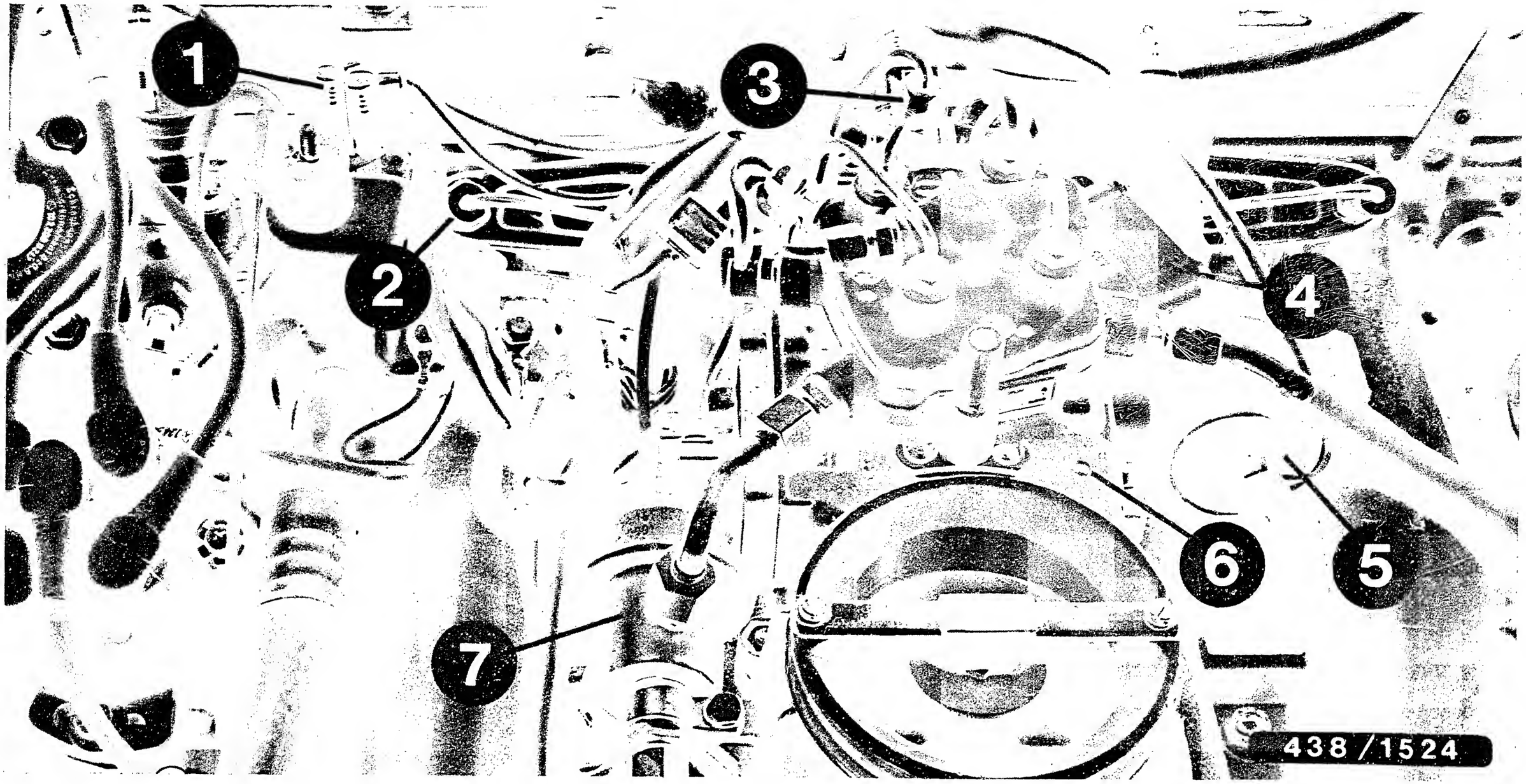
1 = Electronic relay for electric fuel pump and cold-start valve actuation

2 = Over-voltage protection relay

3 = KE-Jetronic control unit

4 = ABS controller (if present)

INSTALLATION POSITION OF COMPONENTS



1 = Engine temperature sensor
2 = Injection valves
3 = Cold-start valve
4 = Pressure actuator
5 = Idle actuator
6 = Mixture-control unit
7 = Pressure regulator

INSTALLATION POSITION OF COMPONENTS

T A B L E O F C O N T E N T S

Trouble-shooting instructions : MB-5007

BOSCH system : KE 3.1 - Jetronic

Vehicle make : MERCEDES-BENZ

Basic microcard : PKW-014

Tests without coordinate details are not applicable in these trouble-shooting instructions.

SPECIAL FEATURES

* These instructions contain the trouble-shooting instructions, valid at the time of publication, for the following model:

  MERCEDES-BENZ
  260 E, SE 2,6l/6Zyl. 07.85->
  190 E 2.6 2,6l/6Zyl. 04.86->

* Trouble-shooting with theses instructions may only then take place when the details of the "Summary - Service Information for Vehicles" (KFZ-0..) coincide with those of the vehicle type and with the BOSCH number of the KE-Jetronic control unit installed.

* Control unit using digital techniques, characteristic-map control using microprocessor.

* Multi-functional fuel-management system with a characteristic map for operation with lambda closed-loop control (CAT) and a characteristic map for operation without lambda closed-loop control (ECE). Activation of the characteristic maps by trimming plug with corresponding marking. To set to the fuel grades unleaded regular and unleaded premium, only the ignition trimming plug must be re-connected.

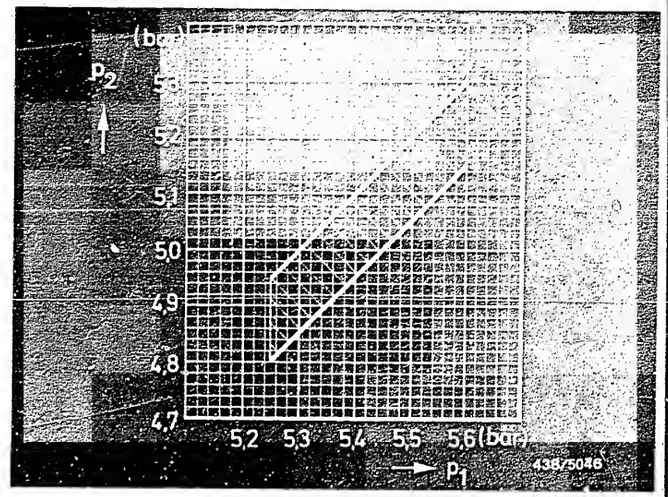
* Electronically controlled idle-speed control with single-winding rotary actuator, without bypass adjusting screw.

* Activated-carbon filter and regeneration valve for return of gasoline vapors into the intake manifold. (Fuel evaporation system)

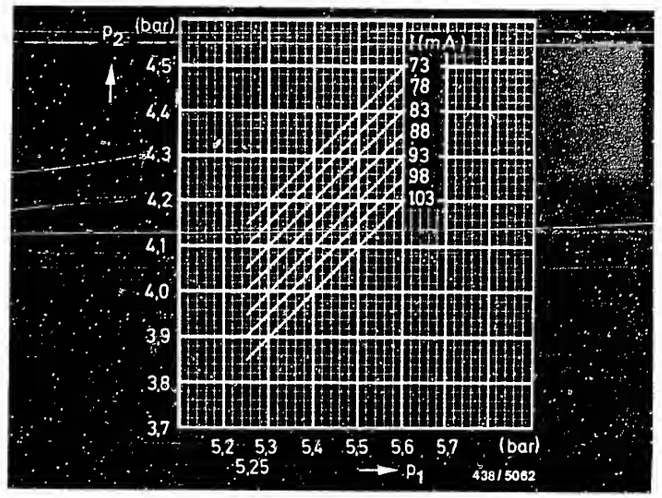
Important note:
If reference is made to a basic microcard, always make certain you use the test specifications from the vehicle-specific brief instructions.

TEST SPECIFICATIONS

No.	Testing/Test condition	Test specification	
1	Electric fuel pump – fuel delivery:	At least 1300 cm ^{3} /min	
2	Primary pressure:	5,25...5,6 bar	
3	Differential pressure: Suppression of peak coil current: Actuate starting motor with fuel-pump relay disconnected. Do not switch off ignition after starting. Take lower-chamber pressure set value "warm" from top chart corresponding to primary pressure measured. (Actuator current 0 mA) Take lower-chamber pressure set value "cold" from bottom chart corresponding to primary pressure measured and actuator current. Tolerance ± 0,15 bar. Simulation of "cold" state: press push-button 3 at test adapter.		
4	Leakage test, complete system: Minimum pressure after 10 mins: Minimum pressure after 20 mins:	 2,7 bar 2,6 bar	
5	Injection valves, opening pressure:	3,0...4,1 bar	
6	Fuel deliveries, comparative measurement: (Actuator current 0 mA) Idle: Part load: Full load: Min. delivery at max. air-flow sensor plate defl.:	Setting point: (cm ^{3} /min) 6,0 40,0 100,0 140 cm ^{3} /min	Max. permis. delivery: (cm ^{3} /min) 6,6 42,5 109,0



p 1 = Primary pressure
p 2 = Lower-chamber pressure

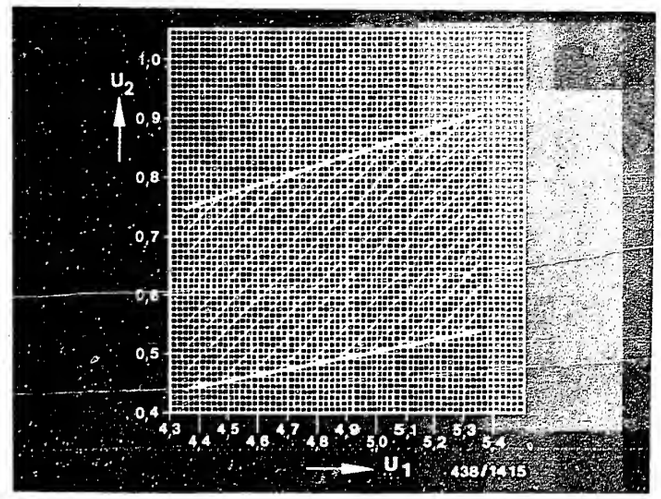


TEST SPECIFICATIONS (CONTINUED)

No.	Testing/requirements for testing	Test specification
7	KE-throttle flow-through quantity:	130...150 cm^3 /min
8	Air-temperature sensor (NTC I): Air temperature +15...+30°C:	 1,3...3,6 k Ω
9	Engine-temperature sensor (NTC II): Engine cold (+15...+30°C): Engine warm (approx. +80°C):	 1,3...3,6 k Ω 250...390 Ω
10	Idle-mixture-adjusting screw - basic adjustment: Fuel-distributor support - needle bearing:	 20,9...21,6 mm
11	Idle-speed adjustment: Idle-speed regulation: Adjustment of idle air quantity not possible. Engine must be at operating temperature for testing. Idle speed: Shift to driving position, engine speed: <u>ECE only</u>: CO concentration in exhaust: <u>CAT only</u>: Test lambda closed-loop control: Measurement with lambda closed-loop tester (e.g. KDJE-P 600) and adapter cable (e.g. KDJE-P 600/52) at diagnostic socket (pin 3). Alternative: current measurement with universal test adapter. Render fuel evaporation control system inoperative. Determine the on-off ratio (mean value) at n = 2500 min^{-1} . Deviation of the on-off ratio (mean value) in idle with respect to n = 2500 min^{-1} : Adjustment at idle-mixture-adjusting screw. After correction, repeat measurement.	 650...750 min^{-1} 550...650 min^{-1} 0,5...1,5 vol. % -10...+10 %

TEST SPECIFICATIONS (CONTINUED)

No.	Testing/Test condition	Test specification
12	Signal, air-flow sensor potentiometer: (Checking necessary when poor idle and/or part-load behavior) Measurement using test adapter and voltmeter. Determine supply voltage of potentiometer: Set value (test adapter, V-position 10): Determine potentiometer signal at idle speed. (Test adapter, V-position 11) Set value corresponding to supply voltage: Adjust signal if necessary at trimming potentiometer (at right next to potentiometer pins). Afterwards, re-secure adjusting screw of trimming potentiometer using black sealing compound (e.g Teroson).	 4,35...5,35 V See chart



U_1 = Supply voltage potentiometer

U_2 = Potentiometer voltage signal

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Important note on the rapid diagnosis chart:

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The "Test connections" column provides information about the leads connected to the respective measuring path, referring to the assignment in the control-unit plug. Possibly necessary trouble-shooting is with regard to these leads.

The "Test specifications" column contains the test specifications for both the version without lambda closed-loop control (ECE, left-hand test-specifications column) and for the version with lambda closed-loop control (CAT, right-hand test-specifications column). Before starting testing, determine which version is being tested. If only one test specification is given, this applies to both versions.

Attention: When carrying out the test, make sure that the trimming plug is in position 1.

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (CONTINUED)

No.	Switch/Btn V	Ω	Btn	Under test	Test pins	Test conditions	Test specifications
1	V	4	–	Int. resistance(R_1) pressure actuator	12–10	Disconnect control-unit lead plug.	20...30 Ω
2	V	5	–	Resistor NTC II (engine)	21– 2	Engine temperature +15°...+30° C: approx. +80° C:	1,3...3,6k Ω 250...390 Ω
3	V	6	–	Resistor NTC I (intake air)	11– 2	Air temperature in area of NTC I: +15°...+30° C:	1,3...3,6k Ω
4				Signal, altitude sensor		Connect control unit. Switch on ignition. Voltmeter connection to blue Ω sockets. Signal altitude-dependent: 0 meters (sea level): 500 meters: 1000 meters: 1500 meters: 2000 meters: 3000 meters:	Test step not applicable!
5	V	9	–	Throttle-valve switch, idle	13– 2	Switch off ignition. Disconnect control-unit lead plug. Throttle valve closed: open:	0...10 Ω > 1000 Ω
6	V	10	–	Throttle-valve switch, full load	5– 2	Throttle valve closed: fully open:	> 5000 Ω 0...10 Ω
7	V	11	–	Microswitch idle linkage	24– 2	Throttle valve closed: open:	0...10 Ω infinite Ω
8	V	12	–	Ground, control unit	20– 2		0...10 Ω
9	V	13	–	Ground, pin 7	7– 2	Switch off ignition. Connect control unit.	0...10 Ω

RAPID DAIGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 010.01 (CONTINUED)

No.	Switch/Btn V	Switch/Btn Ω	Switch/Btn Btn	Under test	Test pins	Test conditions	Test specifications ECE	Test specifications CAT
10	| V	14	–	Trimming plug mixture map	22– 2	Disconnect control-unit lead plug. Disconnect lead plug from air-flow sensor potentiometer and connect socket 1 of plug (in upper installation position) with engine ground. Trimming-plug position 1: 2: 3: 4: 5: 6: 7:	 50... 60 Ω 100...120 Ω 150...190 Ω 230...270 Ω 330...370 Ω 430...470 Ω 570...620 Ω	 900... 1050 Ω 1200... 1350 Ω 1500... 1750 Ω 2000... 2400 Ω 3000... 3600 Ω 5000... 5600 Ω 11000...12000 Ω
11	| V	15	–	Transmission switch (only automatic transmission)	16– 2	Connect air-flow sensor potentiometer. Selection lever in position P, N: Driving position selected:	 0...10 Ω Infinite Ω	
12	5	–	–	TD signal	25– 2	Start engine (starting motor):	Voltage indefined	
13	6	–	–	Control-unit supply	1– 2	Switch on ignition:	8...15 V	
14	7	–	–	Idle actuator supply and continuity	3– 2	Switch on ignition:	8...15 V	
15	8	–	–	Tempomat signal	6– 2	Switch Tempomat operation:	——— V	
16	9	–	–	Air-conditioner cut-in signal	19– 2	Connect control unit. Start engine, switch on air conditioner. Temperature regulator = minimum temperature:	 8...15 V	
17	10	–	–	Supply, air-flow sensor potentiometer	18– 2	Switch on ignition:	4,35...5,35 V	

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (CONTINUED)

No.	Switch/Btn V	Ω	Btn	Under test	Test pins	Test conditions	Test specificatons ECE	CAT
18	11	–	–	Signal, air–flow sensor potentiometer	17– 2	Switch on ignition. Air–flow sensor plate in neutral position: Deflect air–flow sensor plate by hand, continuous voltage rise up to max.:	0 V 5,35 V	
19	13	–	1	Temperature signal from control unit	9– 2	Switch on ignition. While actuating btn 1:	1,5...1,9 V	
20	14	–	–	Consumption signal	4– 2	Start engine – idle: With regulation:	Voltage indefined Voltage change	
21	–	–	–	Peak coil current	12–12	Switch on ignition:	–>FD —— : ——— mA FD 546–>: 9...11 mA	–>FD —— : ——— mA FD 546–>: 18...22 mA
22	–	–	1	Warm–up enrichment +20°C	12–12	Warm up engine – idle. Current value with btn 1 pressed:	–>FD —— : ——— mA FD 546–>: 14...19 mA	–>FD —— : ——— mA FD 546–>: 2... 6 mA
23	–	24	2	Actuator current Engine at norm. op. temp.	12–12	Eng. at norm. op. temp., idle Current valve with btn 2 pressed: With CAT, oscillating, mean value:	–>FD —— : ——— mA FD 546–>: –4...+7 mA	–>FD —— : ——— mA FD 546–>: –1...+1 mA
24	–	21	1	Starting enrichment	12–12	So that eng. fails to start: Disconnect speed relay for elec. fuel pump. Short circuit ign. coil term.4 to grnd via resist. of at least 2k Ω (E.g. with sleeve–type suppressor and spark gap) While btn 1 pressed, actuate starting motor. Current rise (max. 1 s.) to:	–>FD —— : ——— mA FD 546–>: 65...85 mA	–>FD —— : ——— mA FD 546–>: 50...70 mA

FD = Date of manufacture

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (CONTINUED)

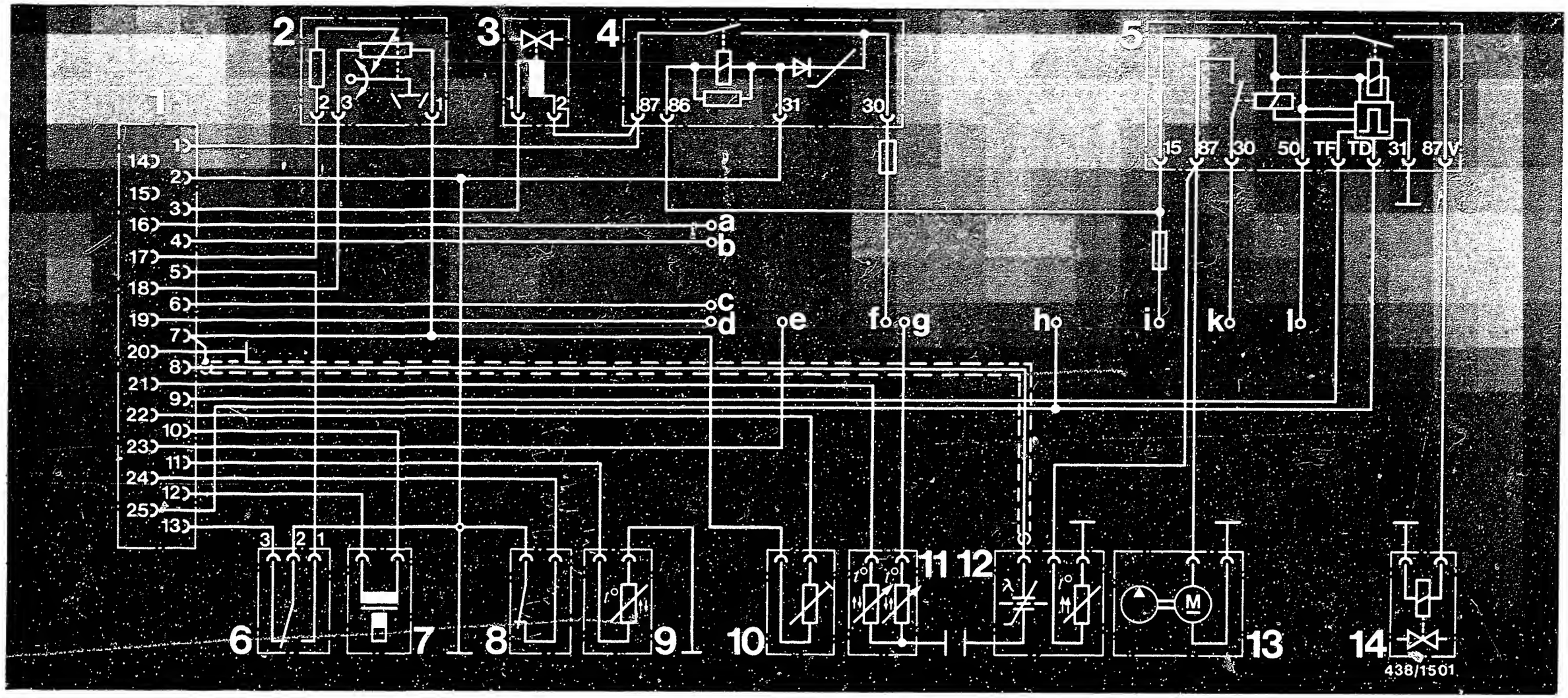
No.	Switch/Btn. V	Ω	Btn.	Subject of testing	Test pins	Test conditions	Test specifications ECE	CAT
25	–	21	1	Post-start enrichment	12-12	Start engine (at normal operating temperature) while operating btn. 1. Current value: Current constant for several seconds, then slow decrease to control level.	->FD —— : ——— mA FD 546->: 20...28 mA	->FD —— : ——— mA FD 546->: 5...12 mA
26	–	21	1	Acceleration enrichment	12-12	Engine at operating temp., idling. While pressing btn. 1, sharply accelerate engine. Current increase (approx. 1s) to: <u>Note:</u> The level of current depends on the intensity of acceleration (travel/time of sensor-plate movement).	->FD —— : ——— mA FD 546->: 30...70 mA	->FD —— : ——— mA FD 546->: 25...65 mA
27	–	–	–	Overrun cut-off	12-12	Change connections on ammeter (swap pos. and negative). Run vehicle on chassis dynamometer or road. Increase eng. speed n briefly to at least approx.: Current reading during falling engine-speed phase: (throttle-valve switch idle closed)	->FD —— : ——— min^{-1} FD 546->: 2500 min^{-1} -40...-80 mA	->FD 643 : 4000 min^{-1} FD 644->: 2500 min^{-1} -40...-80 mA

FD = Date of manufacture

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (CONTINUED)

No.	Switch/Btn. V	Ω	Btn.	Subject of testing	Test pins	Test conditions	Test specifications ECE	CAT
28	–	21	–	Full-load enrichment	12-12	Engine at operating temp., idling. Current: Briefly depress accelerator pedal all the way (throttle-valve switch must switch full load). During engine-speed increase, current increase by: Important: Keep this step very brief, to prevent the engine speed from rising too much and damaging the engine.	->FD —— : ——— mA FD 546->: -4...+7 mA ->FD —— : ——— mA FD 546->: 4...10 mA	->FD —— : ——— mA FD 546->: -1...+1 mA ->FD —— : ——— mA FD 546->: 4...10 mA
29	–	21	–	Lambda closed-loop control, open-loop operation	12-12	Remove regeneration line to throttle-valve assembly at regeneration valve and seal off. Engine at operating temp. at idle. Current:	——	-1...+1 mA
30	–	24	–	Lambda closed-loop control, closed-loop operation	12-12	Engine at operating temp. at idle. Closed-loop operation can be recognized by the oscillating current reading. Mean value: If mean value outside tolerance, set (using idle-mixture-adjusting screw) to:	—— ——	-1...+1 mA approx. 0 mA
31	–	22	–	Lambda closed-loop control rich stop	12-12	Engine at operating temp. at idle. Current rise to:	——	12...16 mA
32	–	23	–	Lambda closed-loop control lean stop	12-12	Engine at operating temp. at idle. Current drop to:	——	-8...-12 mA

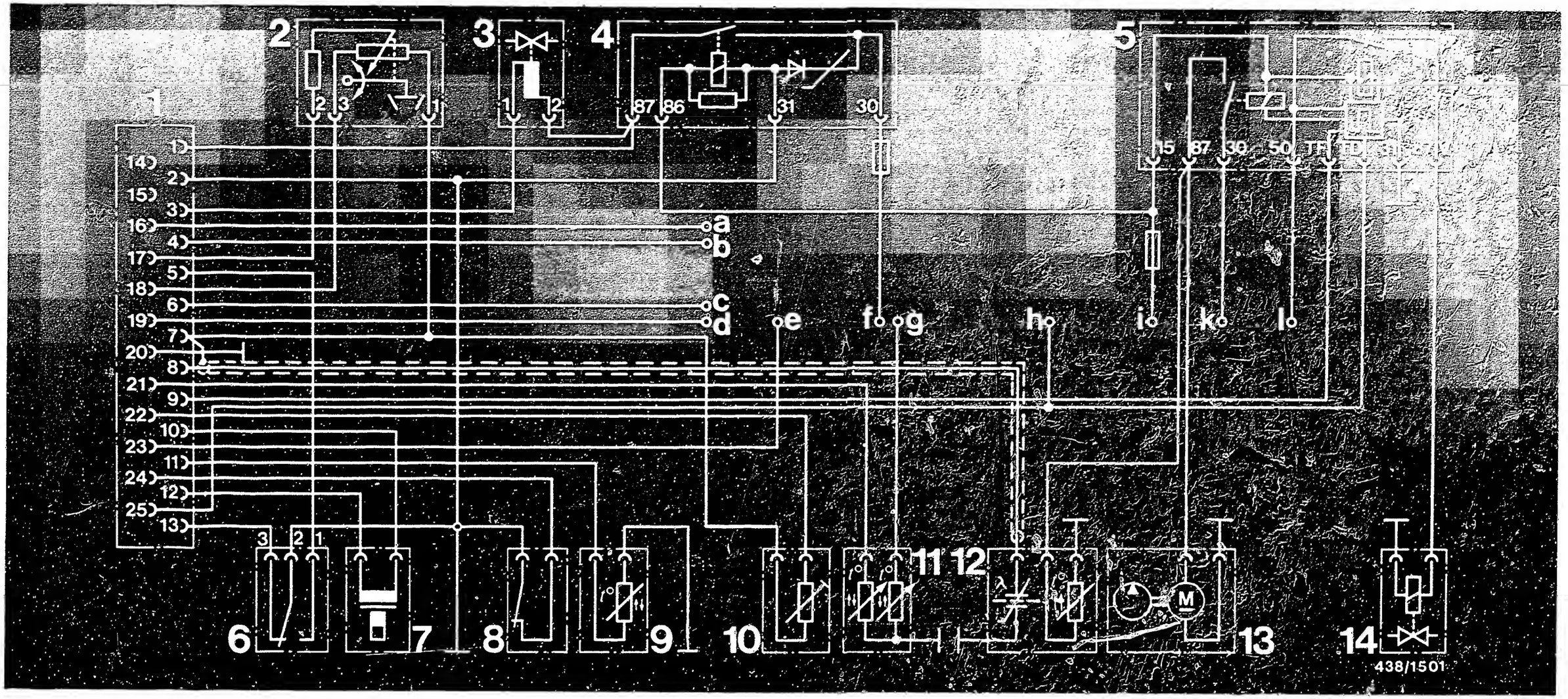
FD = Date of manufacture



1 = Control-unit, KE-Jetronic
2 = Air-flow sensor potentiometer
3 = Idle actuator
4 = Over-voltage protection relay
5 = Electronic relay for electric fuel pump and cold-start valve actuation
6 = Throttle-valve switch, idle/full load
7 = Electro-hydraulic pressure actuator
8 = Throttle-valve switch, idle/linkage
9 = Temperature sensor, intake air (NTC I)
10 = Trimming plug, map adjustment
11 = Temperature sensor, engine (Double NTC)
12 = Heated lambda sensor
13 = Electric fuel pump
14 = Cold-start valve

ELECTRICAL TERMINAL DIAGRAM WITH ELECTRIC FUEL PUMP SAFETY CIRCUIT

K21 ⟹ K22 ⟸⟹

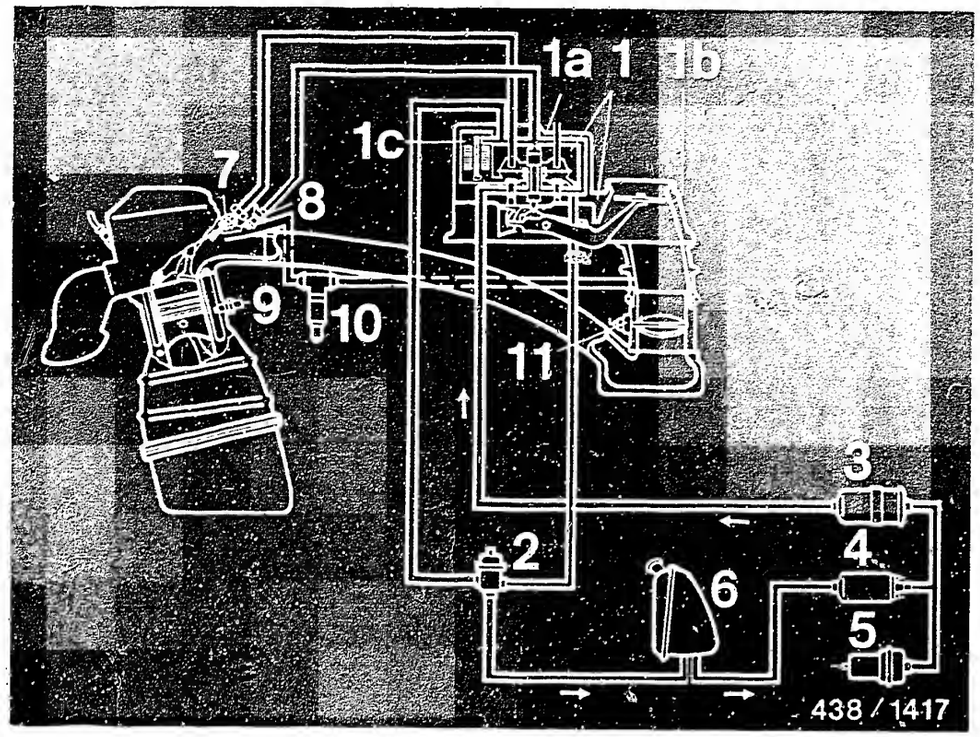


a = Transmission switch (automatic only)
b = Consumption signal
c = Connection of Tempomat operating element
d = Connection of air-conditioner control unit
e = Lambda test output

f = Terminal 30 (B +)
g = Ignition system (EZ-L)
h = TD signal, ignition
i = Terminal 15
k = Terminal 30 (B +)
l = Terminal 15a - starting motor

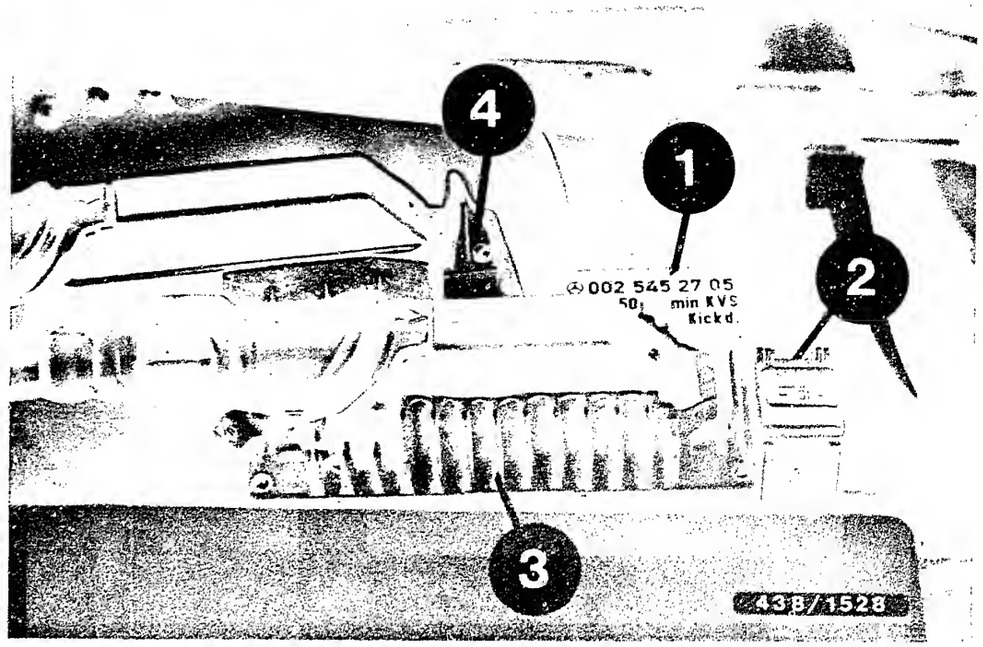
Electrical terminal diagram with electric fuel pump safety circuit (continued)

K23 ⟸ K24 ⟸



1 = Mixture-control unit
1a = Fuel distributor
1b = Air-flow sensor
1c = Electro-hydraulic pressure actuator
2 = Pressure regulator, primary pressure
3 = Fuel filter
4 = Electric fuel pump
5 = Fuel accumulator
6 = Fuel tank
7 = Injection valve
8 = Cold-start valve
9 = Temperature sensor engine (Double NTC)
10 = Idle actuator
11 = Throttle-valve switch, idle/full load

DIAGRAM OF AIR AND FUEL LINES



1 = Electronic relay for electric-fuel-pump and cold-start valve actuation

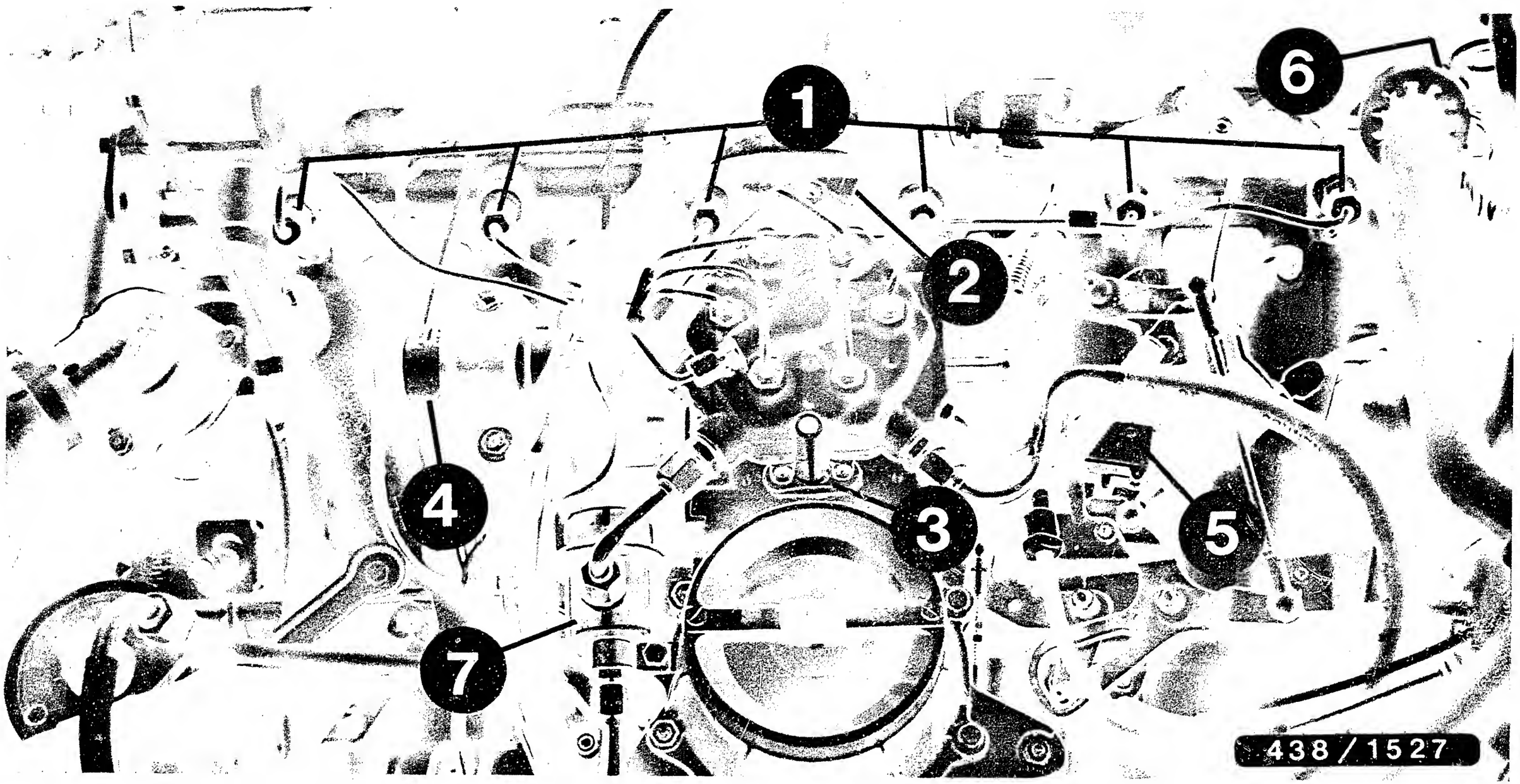
2 = Over-voltage protection relay

3 = KE-Jetronic control unit

4 = ABS controller (if present)

In Type 126, the electric fuel pump relay and the over-voltage protection relay are positioned in the engine compartment on the left.
The KE-Jetronic control unit and the mixture map trimming plug are installed in the footwell on the right behind the side panel in the Type 126.

INSTALLATION POSITION OF COMPONENTS



1 = Fuel-injection valves
2 = Start valve
3 = Mixture-control unit
4 = Idle actuator
5 = Throttle-valve switch, idle (microswitch on accelerator linkage)
6 = Engine-temperature sensor (concealed)
7 = Pressure regulator

INSTALLATION POSITION OF COMPONENTS

T A B L E O F C O N T E N T S

Trouble-shooting instructions	:	MB-5008
BOSCH system	:	KE 3.1 - Jetronic
Vehicle make	:	MERCEDES-BENZ
Basic microcard	:	PKW-014

Tests without coordinate details are not applicable in these trouble-shooting instructions.

SPECIAL FEATURES

* This microcard contains the trouble-shooting instructions for the following Mercedes-Benz model valid at the time of writing:

  300 E,SE,SEL, 3,01/6Zyl. CH/S 12.85->

* Trouble-shooting with these instructions can be done only when the data of the "After-Sales-Service Information for Vehicles" (KFZ-000) correspond to the the vehicle type and the BOSCH number of the KE-Jetronic control unit installed.

* Control unit with digital technology, characteristic-map controlled by microprocessor.

* Electronically-controlled idle-speed regulation with single-winding rotary actuator, without bypass adjusting screw.

* Activated carbon filter and regeneration valve for returning gasoline fumes into the intake manifold (Fuel evaporation control system).

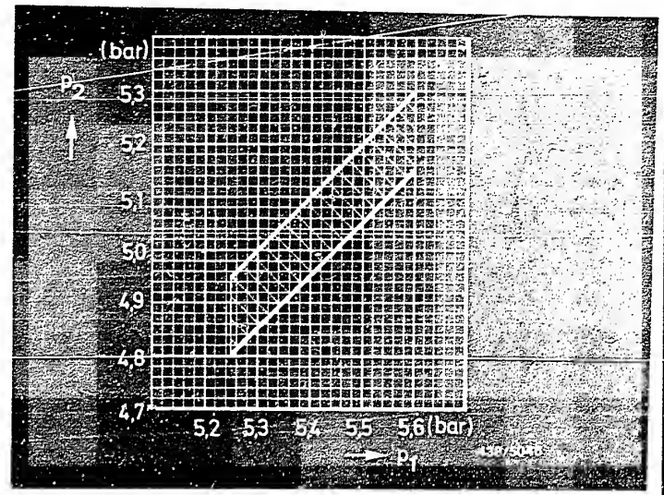
* Exhaust-gas recirculation (non-Bosch system)

Important note:

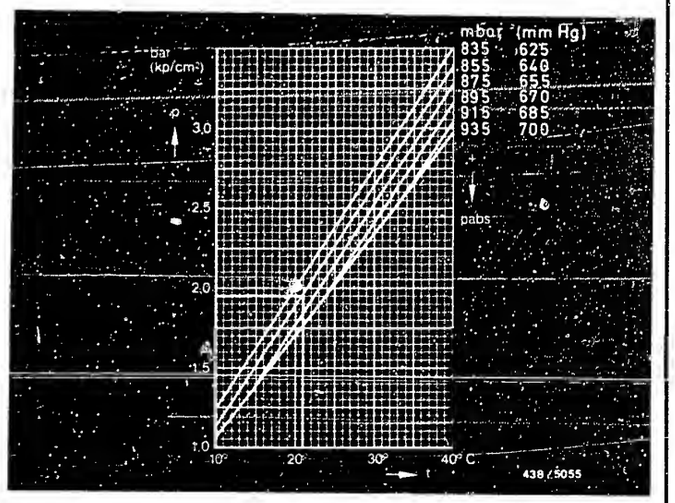
When referring to a basic microcard, note that the test specifications should always be taken from the vehicle-specific brief instructions.

TEST SPECIFICATIONS

No.	Testing/Test condition	Test specification
1	Electric fuel pump – fuel delivery:	At least 1400 cm ^{3} /min
2	Primary pressure:	5,25...5,6 bar
3	Differential pressure: Suppression of peak coil current: Actuate starting motor with fuel-pump relay disconnected. Do not switch off ignition after starting. Take lower-chamber pressure set value "warm" from top chart corresponding to primary pressure measured. (Actuator current 0 mA) Take lower-chamber pressure set value "cold" from bottom chart corresponding to primary pressure measured and actuator current. Tolerance ± 0,15 bar. Simulation of "cold" state: press push-button 3 at test adapter.	
4	Leakage test, complete system: Minimum pressure after 10 mins: Minimum pressure after 20 mins:	 2,7 bar 2,6 bar
5	Injection valves, opening pressure:	3,0...4,1 bar
6	Fuel deliveries, comparative measurement: (Actuator current 0 mA)	Setting point: (cm ^{3} /min) / Max. permis. delivery: (cm ^{3} /min)
	Idle:	6,0 / 6,6
	Part load:	40,0 / 42,5
	Full load:	100,0 / 109,0
	Min. delivery at max. air-flow sensor plate defl.:	140 cm ^{3} /min



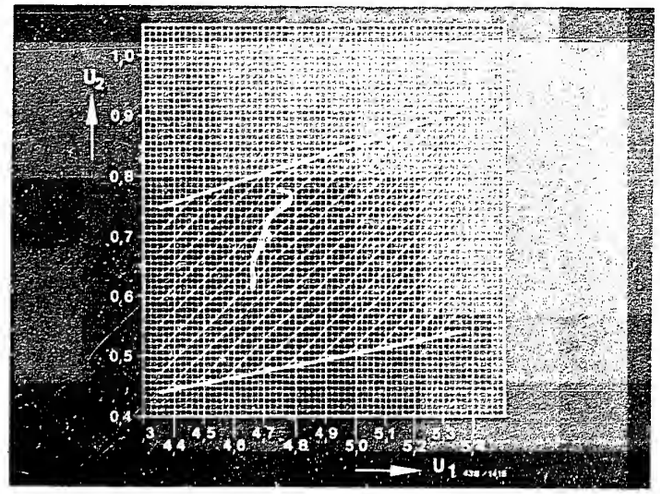
p_1 = Primary pressure
p_2 = Lower-chamber pressure



No.	Testing/requirements for testing	Test specification
7	KE-throttle flow-through quantity:	130...150 cm^3 /min
8	Air-temperature sensor (NTC I): Air temperature +15...+30°C:	 1,3...3,6 k Ω
9	Engine-temperature sensor (NTC II): Engine cold (+15...+30°C): Engine warm (approx. +80°C):	 1,3...3,6 k Ω 250...390 Ω
10	Idle-mixture-adjusting screw basic setting: Fuel-distributor support – needle bearing:	 20,5...21,6 mm
11	Idle-speed adjustment: Idle-speed regulation: Adjustment of the idle air quantity not possible. Engine must be at operating temperature for testing. Idle speed: Shift to driving position, engine speed: CO concentration in exhaust: Adjust at idle-mixture-adjusting screw. After correction, repeat measurement.	 720...820 min^{-1} 600...700 min^{-1} 0,3...0,9 vol.-%

TEST SPECIFICATIONS (CONTINUED)

No.	Testing/Test condition	Test specification
12	Signal, air-flow sensor potentiometer: (Checking necessary when poor idle and/or part-load behavior) Measurement using test adapter and voltmeter. Determine supply voltage of potentiometer: Set value (test adapter, V-position 10): Determine potentiometer signal at idle speed. (Test adapter, V-position 11) Set value corresponding to supply voltage: Adjust signal if necessary at trimming potentiometer (at right next to potentiometer pins). Afterwards, re-secure adjusting screw of trimming potentiometer using black sealing compound (e.g Teroson).	 4,35...5,35 V See chart



U_1 = Supply voltage potentiometer

U_2 = Potentiometer voltage signal

SELF-DIAGNOSIS

All Daimler-Benz 4- and 6-cylinder engines in the current series (approx. 10.85) are equipped with self-diagnosis using on-off ratio measurement.

Incorrect input signals from the KE-Jetronic control unit can be displayed with the lambda closed-loop tester at the lambda test output (diagnosis socket, socket 3).

This provides information on short and open circuits. Defects which occur sporadically (e.g. loose contacts) are not indicated. Output of fault signals has priority over output of the lambda closed-loop signal.

We will not go into the defects which can be indicated in more detail here, since the input signals of the KE-Jetronic control unit can be tested with the universal test adapter (rapid-diagnosis chart).

However, if when testing the lambda closed-loop control by means of on-off ratio measurement, a constant on-off ratio is indicated, then the input signals of the KE-Jetronic control unit should be tested (rapid diagnosis chart).

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER
ETT 018.01 WITH KE3 ADAPTER LEAD
1 684 463 169 AND APPROPRIATE MULTITESTER:

The following rapid diagnosis chart makes it possible for the experienced Jetronic expert to quickly check the electric/electronic peripheral and control-unit functions of the the KE-Jetronic, inlcuding the lambda closed-loop control.

Important note on the rapid diagnosis chart:

The "Test conditions" column gives information as to in which test steps the control-unit plug must be connected/disconnected. Make absolutely certain that there is no current at the system when connecting or disconnecting, i.e. the ignition must be switched off and the electric safety circuit must not be short circuited.

The "Test connections" column provides information about the leads connected to the respective measuring path, referring to the assignment in the control-unit plug. Possibly necessary trouble-shooting is with regard to these leads.

A t t e n t i o n :

When carrying out the test, make sure that the trimming plug is in position 1.

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (CONTINUED)

No.	Switch/Btn V	Ω	Btn	Under test	Test pins	Test conditions	Test specifications
1	| V	4	–	Int. resistance(R_i) pressure actuator	12–10	Disconnect control-unit lead plug.	20...30 Ω
2	| V	5	–	Resistor NTC II (engine)	21– 2	Engine temperature +15°...+30° C: approx. +80° C:	1,3...3,6k Ω 250...390 Ω
3	| V	6	–	Resistor NTC I (intake air)	11– 2	Air temperature in area of NTC I: +15°...+30° C:	1,3...3,6k Ω
4				Signal, altitude sensor		Connect control unit. Switch on ignition. Voltmeter connection to blue Ω sockets. Signal altitude-dependent: 0 meters (sea level): 500 meters: 1000 meters: 1500 meters: 2000 meters: 3000 meters:	Test step not applicable!
5	| V	9	–	Throttle-valve switch, idle	13– 2	Switch off ignition. Disconnect control-unit lead plug. Throttle valve closed: open:	0...10 Ω > 1000 Ω
6	| V	10	–	Throttle-valve switch, full load	5– 2	Throttle valve closed: fully open:	> 5000 Ω 0...10 Ω
7	| V	11	–	Microswitch idle linkage	24– 2	Throttle valve closed: open:	0...10 Ω infinite Ω
8	| V	12	–	Ground, control unit	20– 2		0...10 Ω
9	| V	13	–	Ground, pin 7	7– 2	Switch off ignition. Connect control unit.	0...10 Ω

Rapid diagnosis chart for universal test adapter ETT 018.01 (continued)

No.	Switch/Btn V	Ω	Btn	Under test	Test pins	Test conditions	Test specifications
10	V	14	–	Trimming plug Mixture map	22– 2	Disconnect control-unit plug. Disconnect lead plug from air-flow sensor potentiometer and connect socket 1 of plug (in upper installation position) to engine ground. Trimming-plug position 1: 2: 3: 4: 5: 6: 7:	 50... 60 Ω 100...120 Ω 150...190 Ω 230...270 Ω 330...370 Ω 430...470 Ω 570...620 Ω
11	V	15	–	Transmission switch (only automatic transmission)	16– 2	Connect air-flow sensor potentiometer. Selection lever position P, N: Driving position selected:	 0...10 Ω infinite Ω
12	5	–	–	TD signal	25– 2	Start engine (starting motor):	Voltage undefined
13	6	–	–	Control-unit supply	1– 2	Switch on ignition:	8...15 V
14	7	–	–	Idle actuator supply and continuity	3– 2	Switch on ignition:	8...15 V
15	8	–	–	Tempomat signal	6– 2	Switch Tempomat operation:	——— V
16	9	–	–	Air-conditioner cut-in signal	19– 2	Switch off ignition. Connect control unit. Start engine, switch on air conditioner. Temperature regulator = Minimum temperature	 8...15 V
17	10	–	–	Supply, air-flow sensor potentiometer	18– 2	Switch on ignition:	4,35...5,35 V

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (CONTINUED)

No.	Switch/Btn V	Ω	Btn	Under test	Test pins	Test conditions	Test specifications
18	11	–	–	Signal, air–flow sensor potentiometer	17– 2	Switch on ignition. Air–flow sensor plate in rest position: Deflect air–flow sensor plate by hand, continuous voltage rise up to max.:	0 V 5,35 V
19	13	–	1	Temperature signal from control unit	9– 2	Switch on ignition. While actuating btn 1:	1,5...1,9 V
20	14	–	–	Consumption signal	4– 2	Start engine – idle: With regulation:	Voltage undefined Voltage change
21	–	–	–	Peak coil current	12–12	Switch on ignition:	–>FD —— : ——— mA FD 550–>: 9...11 mA
22	–	21	1	Warm–up enrichment + 20°C	12–12	Warm up engine – idle. Current value with btn 1 depressed:	–>FD 647 : 10...14 mA FD 648–>: 8...12 mA
23	–	24	2	Actuator current engine at normal operating temperature	12–12	Engine at normal operating temperature, idle. Current value with btn 2 depressed:	–>FD —— : ——— mA FD 550–>: 1... 4 mA
24	–	21	2	Starting enrichment	12–12	So that engine fails to start: disconnect speed relay for electric fuel pump. Short–circuit ignition coil term. 4 to ground via resistance of at least 2 k Ω . (e.g. with sleeve–type suppressor and spark gap) While btn 2 depressed, actuate starting motor. Current rise (max. 1 sec.) to:	–>FD —— : ——— mA FD 550–>: 40...60 mA

FD = Date of manufacture

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (CONTINUED)

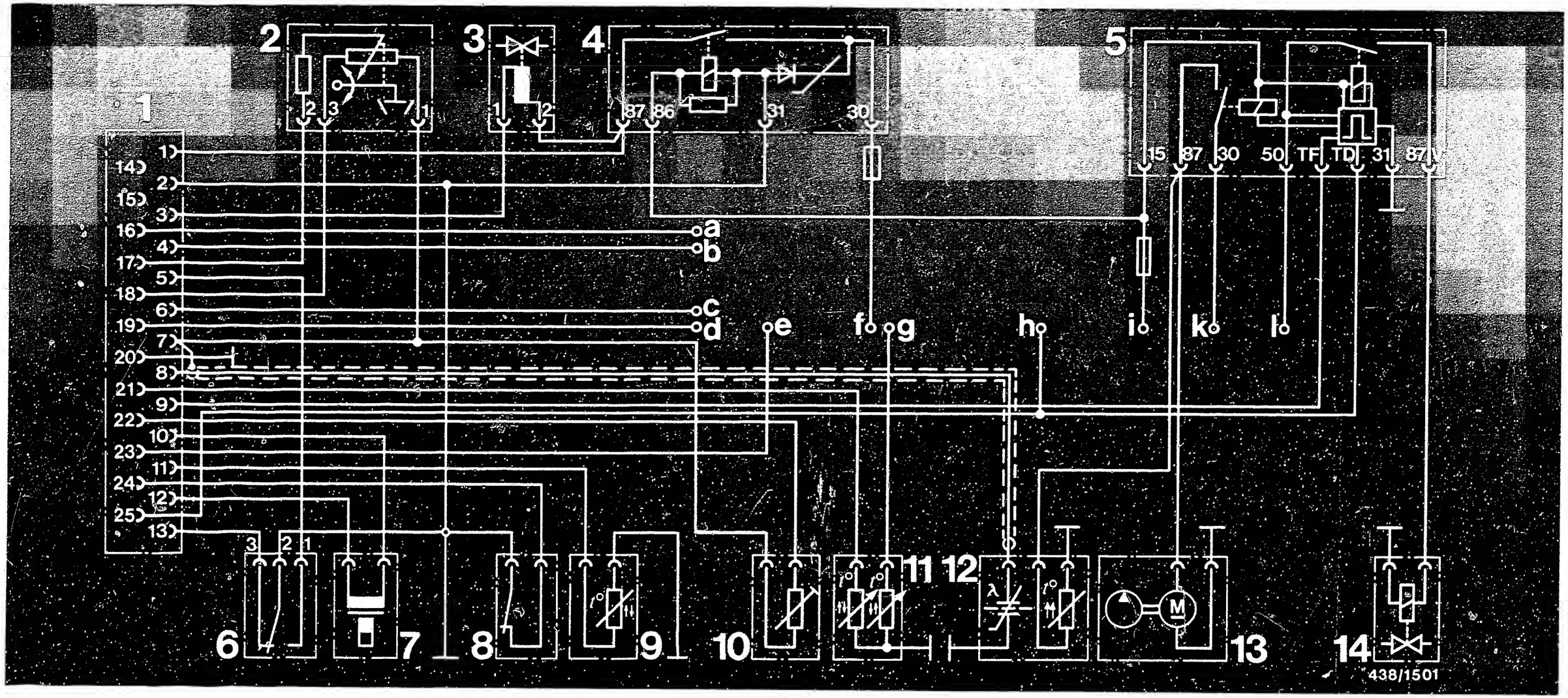
No.	Switch/Btn V	Ω	Btn	Under test	Test pins	Test conditions	Test specifications
25	–	21	1	Post-start enrichment	12-12	Start engine (at normal operating temperature) while actuating btn 1. Current value: Current value constant for a few seconds, then slow speed regulation.	->FD —— : ——— mA FD 550->: 9...13 mA
26	–	21	1	Acceleration enrichment	12-12	Engine at normal operating temperature, idle. While actuating btn 1, perform snap acceleration of engine. Thus current rise (approx. 1 sec.) to: Note: Level of current value dependent upon intensity of acceleration (travel/duration of air-flow sensor plate movement).	->FD —— : ——— mA FD 550->: 30...60 mA
27	–	–	–	Overrun cut-off	12-12	Re-connect ohmmeter (swap positive and negative). Start engine (normal operating temperature). Drive vehicle on chassis dynamometer or road. Increase speed n briefly to at least approx.: Current reading during falling speed phase: (idle throttle-valve switch closed)	->FD —— : ——— min^{-1} FD 550->: 3000 min^{-1} -40...-80 mA

FD = Date of manufacture

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01

No.	Switch/Btn V	Ω	Btn	Under test	Test pins	Test conditions	Test specification
28	–	24	–	Full-load enrichment	12-12	Engine at normal operating temperature, idle. Current value: Briefly push accelerator pedal to floor (full-load throttle-valve switch must switch). During speed rise, current value rises by: A t t e n t i o n: Do this very briefly, so that speed does not rise too much and engine is not damaged.	 ->FD —— : ——— mA FD 550->: 1... 4 mA ->FD —— : ——— mA FD 550->: 6...10 mA

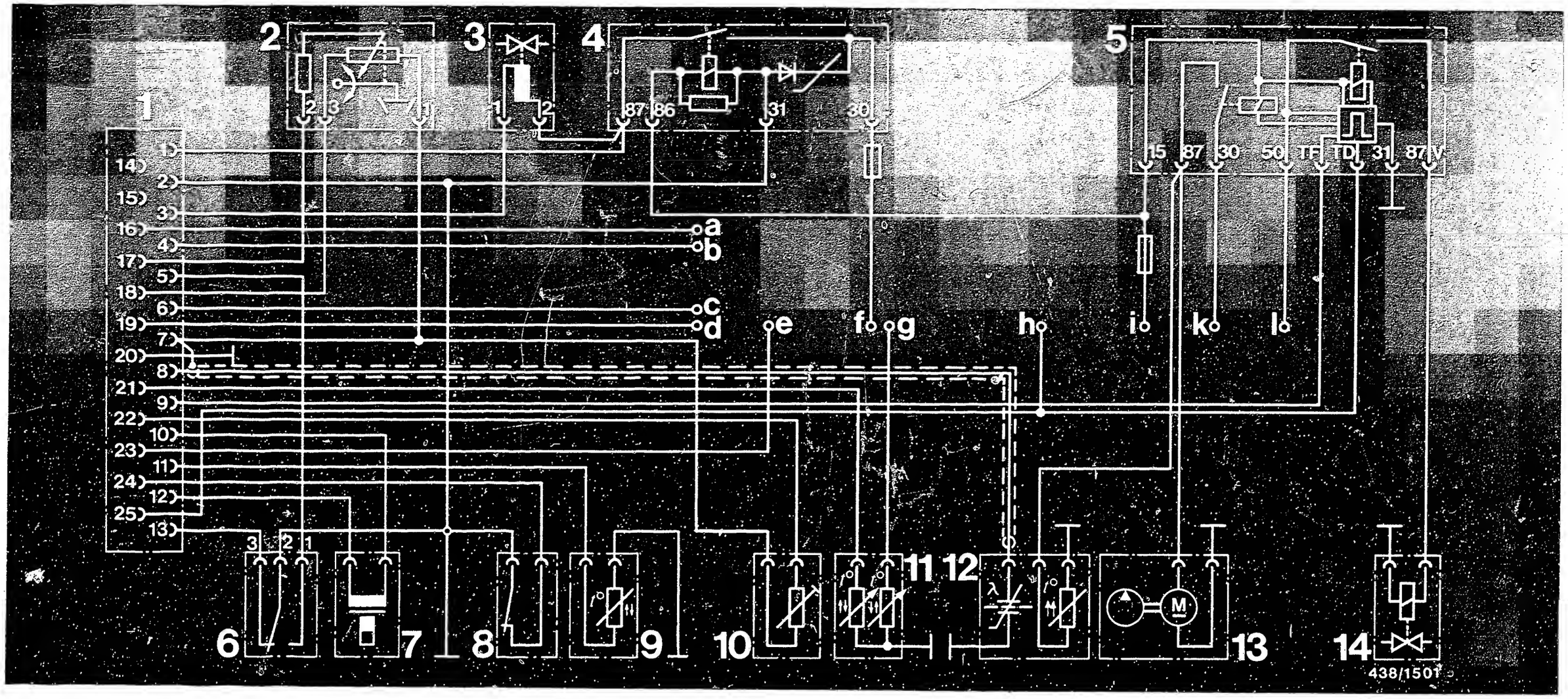
*) FD = Date of manufacture



1 = Control-unit, KE-Jetronic
2 = Air-flow sensor potentiometer
3 = Idle actuator
4 = Over-voltage protection relay
5 = Electronic relay for electric fuel pump and cold-start valve actuation
6 = Throttle-valve switch, idle/full load
7 = Electro-hydraulic pressure actuator
8 = Throttle-valve switch, idle/linkage
9 = Temperature sensor, intake air (NTC I)
10 = Trimming plug, map adjustment
11 = Temperature sensor, engine (Double NTC)
12 = Heated lambda sensor
13 = Electric fuel pump
14 = Cold-start valve

ELECTRICAL TERMINAL DIAGRAM WITH ELECTRIC FUEL PUMP SAFETY CIRCUIT

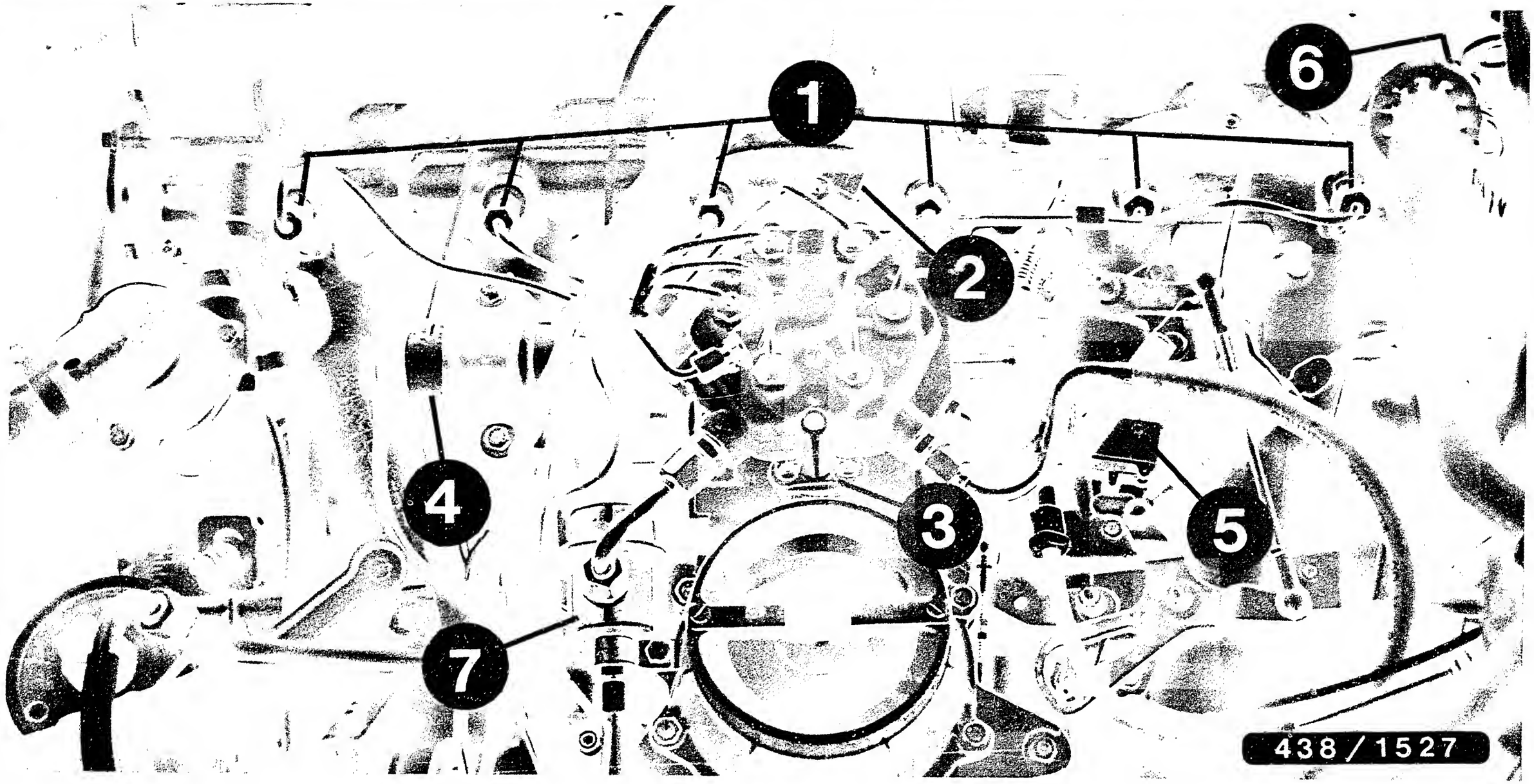
L21 ⟹
L22 ⟺



a = Transmission switch (automatic only)
b = Consumption signal
c = Connection of Tempomat operating element
d = Connection of air-conditioner control unit
e = Lambda test output

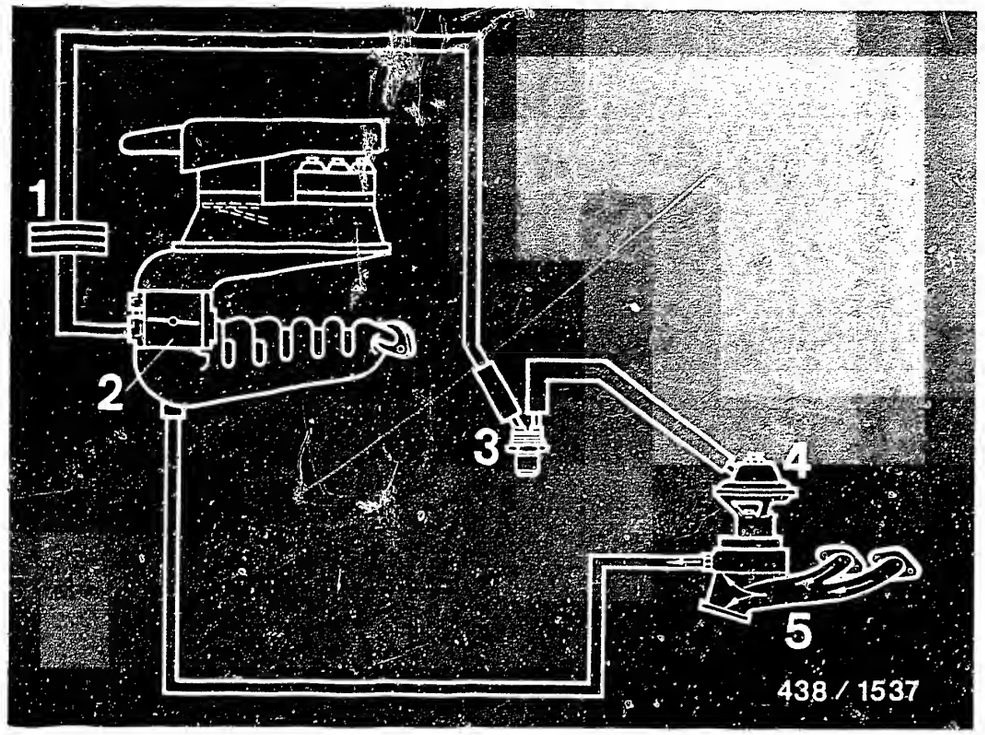
f = Terminal 30 (B +)
g = Ignition system (EZ-L)
h = TD signal, ignition
i = Terminal 15
k = Terminal 30 (B +)
l = Terminal 15a - starting motor

Electrical terminal diagram with electric fuel pump safety circuit (continued)



1 = Fuel-injection valves
2 = Start valve
3 = Mixture-control unit
4 = Idle actuator
5 = Throttle-valve switch, idle (microswitch on accelerator linkage)
6 = Engine-temperature sensor (concealed)
7 = Pressure regulator

INSTALLATION POSITION OF COMPONENTS



1 = Throttle valve
2 = Throttle-valve assembly
3 = Thermo-valve
4 = Exhaust-gas recirculation valve
5 = Exhaust manifold

IMPORTANT GENERAL INFORMATION

Exhaust-gas recirculation

Exhaust-gas recirculation (continued)

In exhaust-gas recirculation, under certain engine operating conditions some of the exhaust gases are returned to the intake tract, to take part in combustion again. This results in a reduction of peak combustion temperatures, thus reducing emissions of oxides of nitrogen (NO_x). Depending on the engine's operating condition, the amount of exhaust gas recirculated is varied, or is cut off entirely.

Exhaust-gas recirculation takes place:

* Above an engine temperature of +40°C
* In the middle and upper part-load range
* Within the part-load range, the amount of exhaust gas is determined depending on intake-manifold vacuum and the throttle-valve position.

<u>Testing exhaust-gas recirculation:</u>

Engine at operating temperature. Slowly increase engine speed. The exhaust-gas recirculation valve should open.

Testing the exhaust-gas recirculation valve: Connect a vacuum tester (e.g. Mityvac pump) and generate vacuum. Opening should start at about 100 mbar, with the valve fully open starting at approx. 200 mbar.

Checking the thermo-valve: Check flow-through and sealing. Vacuum inlet at the slanted fitting.

Checking throttle valve: Check flow-through and sealing. Vacuum inlet at white fitting.

Important information: Disconnect the vacuum hose from the exhaust-gas recirculation valve and seal off before idle-speed adjustment.

T A B L E O F C O N T E N T S

Trouble-shooting instructions	:	MB-5011
BOSCH system	:	KE 3.1-Jetronic
Vehicle make	:	MERCEDES-BENZ
Basic microcard	:	PKW-014

Tests without coordinate details are not applicable in these trouble-shooting instructions.

SPECIAL FEATURES

* This microcard contains the trouble-shooting instructions, valid at the time of publication, for the following Mercedes-Benz model:

  420 SE/SEL/SEC/SL, 4,2l/8Zyl. CH/S 12.85->

* Trouble-shooting with these instructions may only then take place when the details of the "Summary - Service Information for Vehicles" (KFZ-000) coincide with those of the vehicle type and with the BOSCH number of KE-Jetronic control unit installed.

* Control unit using digital techniques, characteristic-map control using microprocessor.

* Electronically controlled low-idle-speed control with single-winding rotary actuator, without bypass adjusting screw.

* Activated-carbon filter and regeneration valve for return of gasoline vapors into the intake manifold. (Fuel evaporation system)

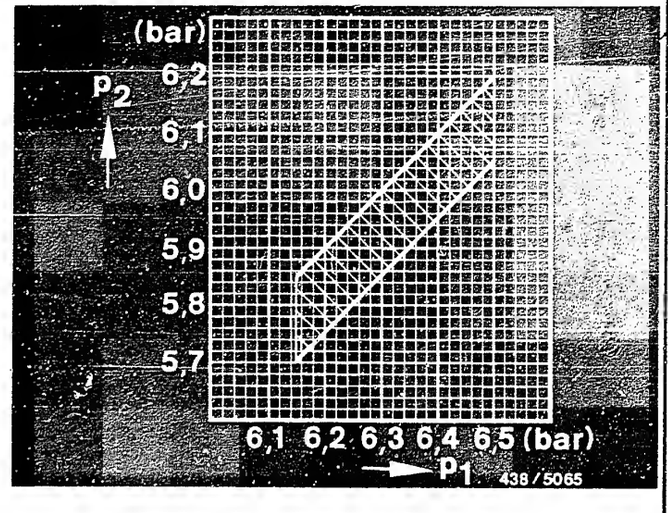
* Secondary-air injection

Important note:

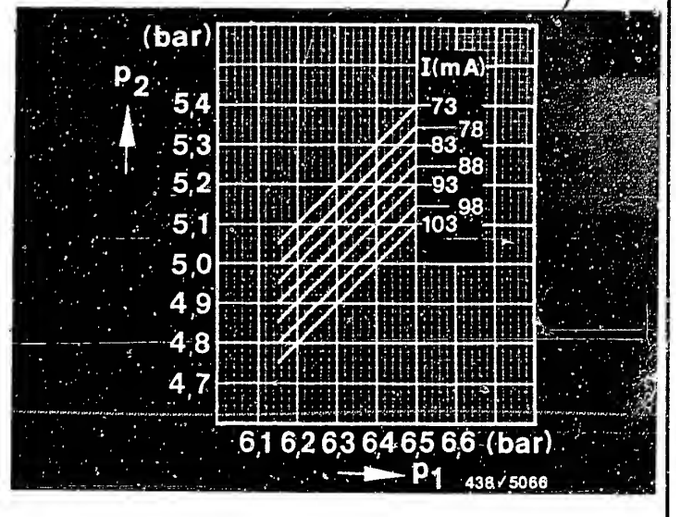
If reference is made to a basic microcard, always make certain you use the test specifications from the vehicle-specific brief instructions.

TEST SPECIFICATIONS

No.	Testing/Test condition	Test specification	
1	Electric fuel pump – fuel delivery:	At least 1650 cm ^{3} /min	
2	Primary pressure:	6,15...6,5 bar	
3	Differential pressure: Suppression of peak coil current: Actuate starting motor with fuel-pump relay disconnected. Do not switch off ignition after starting. Take lower-chamber pressure set value "warm" from top chart corresponding to primary pressure measured. (Actuator current 0 mA) Take lower-chamber pressure set value "cold" from bottom chart corresponding to primary pressure measured and actuator current. Tolerance ± 0.15 bar. Simulation of "cold" state: press push-button 3 at test adapter.		
4	Leakage test, complete system: Minimum pressure after 10 mins: Minimum pressure after 20 mins:	 3,3 bar 3,2 bar	
5	Injection valves, opening pressure:	3,7...4,8 bar	
6	Fuel deliveries, comparative measurement: (Actuator current 0 mA) Idle: Part load: Full load: Min. delivery at max. air-flow sensor plate defl.:	Setting point: (cm ^{3} /min) 6,0 40,0 100,0 140,0 cm ^{3} /min	Max. permis. delivery: (cm ^{3} /min) 6,8 42,5 109,0



p_1 = Primary pressure
p_2 = Lower-chamber pressure



TEST SPECIFICATIONS (CONTINUED)

No.	Testing/Test condition	Test specification
7	Rate of flow, KE restriction:	130...150 cm^3 /min
8	Temperature sensor, air (NTC I): Air temperature +15...+30°C:	 1,3...3,6 k Ω
9	Temperature sensor, engine (NTC II): Engine cold (+15...+30°C): Engine warm (approx. +80°C):	 1,3...3,6 k Ω 250...390 Ω
10	Idle-mixture-adjusting screw basic setting: Fuel-distributor seat - needle bearing:	 22,6...22,8 mm
11	Idle adjustment: Low-idle-speed control (non-Bosch product). For testing, engine at norm. op. temperature Idle speed: Idle-actuator current at idle speed: Engage driving position, speed: Check lambda closed-loop control: Measurement with lambda closed-loop control tester (e.g. KDJE-P 600) and adapter lead (e.g. KDJE-P 600/52) at diagnosis socket outlet (pin 3). Alternatively: Current measurement using universal test adapter. Put fuel evaporation system out of operation. Determine on/off ratio (mean value) at n = 2500 min^{-1} . Deviation of on/off ratio (mean value) at idle compared to n = 2500 min^{-1} : Adjustment at idle-mixture-adjusting screw. After adjustment, repeat measurement.	 600...700 min^{-1} 700...1000 mA 450...550 min^{-1} +5...+15 %

SELF-DIAGNOSIS

All Daimler-Benz 8-cylinder engines have been equipped as of FD 552 with self-diagnosis using on-off ratio measurement.

Defective input signals of the KE-Jetronic control unit may be indicated at the lambda test output (diagnosis socket outlet, socket 3) using the lambda closed-loop control tester.

Short circuiting and breaks in lines are detected. Sporadically occurring faults (e.g. loose contact) are not detected. Output of the fault signals takes priority over output of the lambda closed-loop control signal.

The faults which can be indicated are not discussed in detail here, since the input signals of the KE-Jetronic control unit may be tested using the universal test adapter (rapid diagnosis chart).

However, should a constant on-off ratio be indicated when testing the lambda closed-loop control using on-off ratio measurement, the input signals of the KE-Jetronic control unit must be checked (rapid diagnosis chart).

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 WITH KE3 ADAPTER LEAD 1 684 463 169 AND APPROPRIATE MULTITESTER:

The following rapid diagnosis chart makes it possible for the experienced Jetronic expert to quickly check the electric/electronic peripheral and control-unit functions of the the KE-Jetronic, inlcuding the lambda closed-loop control.

Important note on the rapid diagnosis chart:

The "Test conditions" column gives information as to in which test steps the control-unit plug must be connected/disconnected. Make absolutely certain that there is no current at the system when connecting or disconnecting, i.e. the ignition must be switched off and the electric safety circuit must not be short circuited.

The "Test connections" column provides information about the leads connected to the respective measuring path, referring to the assignment in the control-unit plug. Possibly necessary trouble-shooting is with regard to these leads.

A t t e n t i o n :

When carrying out the test, make sure that the trimming plug is in position 1.

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (CONTINUED)

No.	Switch/Btn V	Ω	Btn	Under test	Test pins	Test conditions	Test specifications
1	V	4	–	Int. resistance(R_1) pressure actuator	12–10	Disconnect control-unit lead plug.	20...30 Ω
2	V	5	–	Resistor NTC II (engine)	21– 2	Engine temperature +15°...+30° C: approx. +80° C:	1,3...3,6k Ω 250...390 Ω
3	V	6	–	Resistor NTC I (intake air)	11– 2	Air temperature in area of NTC I: +15°...+30° C:	1,3...3,6k Ω
4				Signal, altitude sensor		Connect control unit. Switch on ignition. Voltmeter connection to blue Ω sockets. Signal altitude-dependent: 0 meters (sea level): 500 meters: 1000 meters: 1500 meters: 2000 meters: 3000 meters:	Test step not applicable!
5	V	9	–	Throttle-valve switch, idle	13– 2	Switch off ignition. Disconnect control-unit lead plug. Throttle valve closed: open:	0...10 Ω > 1000 Ω
6	V	10	–	Throttle-valve switch, full load	5– 2	Throttle valve closed: fully open:	> 5000 Ω 0...10 Ω
7	V	11	–	Microswitch idle linkage	24– 2	Throttle valve closed: open:	——— Ω infinite Ω
8	V	12	–	Ground, control unit	20– 2		0...10 Ω
9	V	13	–	Ground, pin 7	7– 2	Switch off ignition. Connect control unit.	0...10 Ω

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (CONTINUED)

No.	Switch/Btn V	Ω	Btn	Under test	Test pins	Test conditions	Test specifications
10	↓ V	14	–	Trimming plug mixture map	22– 2	Disconnect control-unit plug. Disconnect lead plug from air-flow sensor potentiometer and connect socket 1 of plug (in upper installation position) to engine ground. Trimming-plug position 1: 2: 3: 4: 5: 6: 7:	 900... 1020 Ω 1200... 1350 Ω 1500... 1750 Ω 2000... 2400 Ω 3000... 3600 Ω 5000... 5600 Ω 11000...12000 Ω
11	↓ V	15	–	Transmission switch (automatic transmission only)	16– 2	Connect air-flow sensor potentiometer. Selection lever in position P, N: Driving position selected:	 0...10 Ω > 3000 Ω
12	5	–	–	TD signal	25– 2	Start engine (starting motor):	Voltage undefined
13	6	–	–	Control-unit supply	1– 2	Switch on ignition:	8...15 V
14	10	–	–	Supply, air-flow sensor potentiometer	18– 2	Switch off ignition. Connect control unit. Switch on ignition:	 4.35...5.35 V
15	11	–	–	Signal, air-flow sensor potentiometer	17– 2	Switch on ignition. Air-flow sensor plate in neutral position: Deflect air-flow sensor plate by hand, continuous voltage rise up to max.:	 Approx. 0 V 5.35 V
16	13	–	1	Temperature signal from control unit	9– 2	Switch on ignition. While actuating btn 1:	 1.5...1.9 V
17	14	–	–	Consumption signal	4– 2	Start engine – idle: With regulation:	Voltage undefined Voltage change

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (CONTINUED)

No.	Switch/Btn V	Ω	Btn	Under test	Test pins	Test conditions	Test specifications
18	–	–	–	Peak coil current	12–12	Switch on ignition:	–>FD ——— : ——— mA FD 549–>: 65...85 mA
19	–	21	2	Actuator current engine at normal operating temperature	12–12	Engine at normal operating temperature, idle. Current value with btn 2 depressed:	–>FD ——— : ——— mA FD 549–>: –1...+1 mA
20	–	21	2	Starting enrichment	12–12	So that engine fails to start: disconnect speed relay for electric fuel pump. Short–circuit ignition coil term. 4 to ground via resistance of at least 2 k Ω (e.g. with sleeve–type suppressor and spark gap). While btn 1 depressed, actuate starting motor. Current rise (max. 1 sec.) to:	–>FD ——— : ——— mA FD 549–>: 80...110 mA
21	–	21	1	Acceleration enrichment	12–12	Engine at normal operating temperature, idle. While actuating btn 1, perform snap acceleration of engine. Thus current rise (approx. 1 s) to: Note: Level of current value dependent upon intensity of acceleration (travel/duration of air–flow sensor flap movement).	–>FD ——— : ——— mA FD 549–>: 20...50 mA

FD = Date of manufacture

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (CONTINUED)

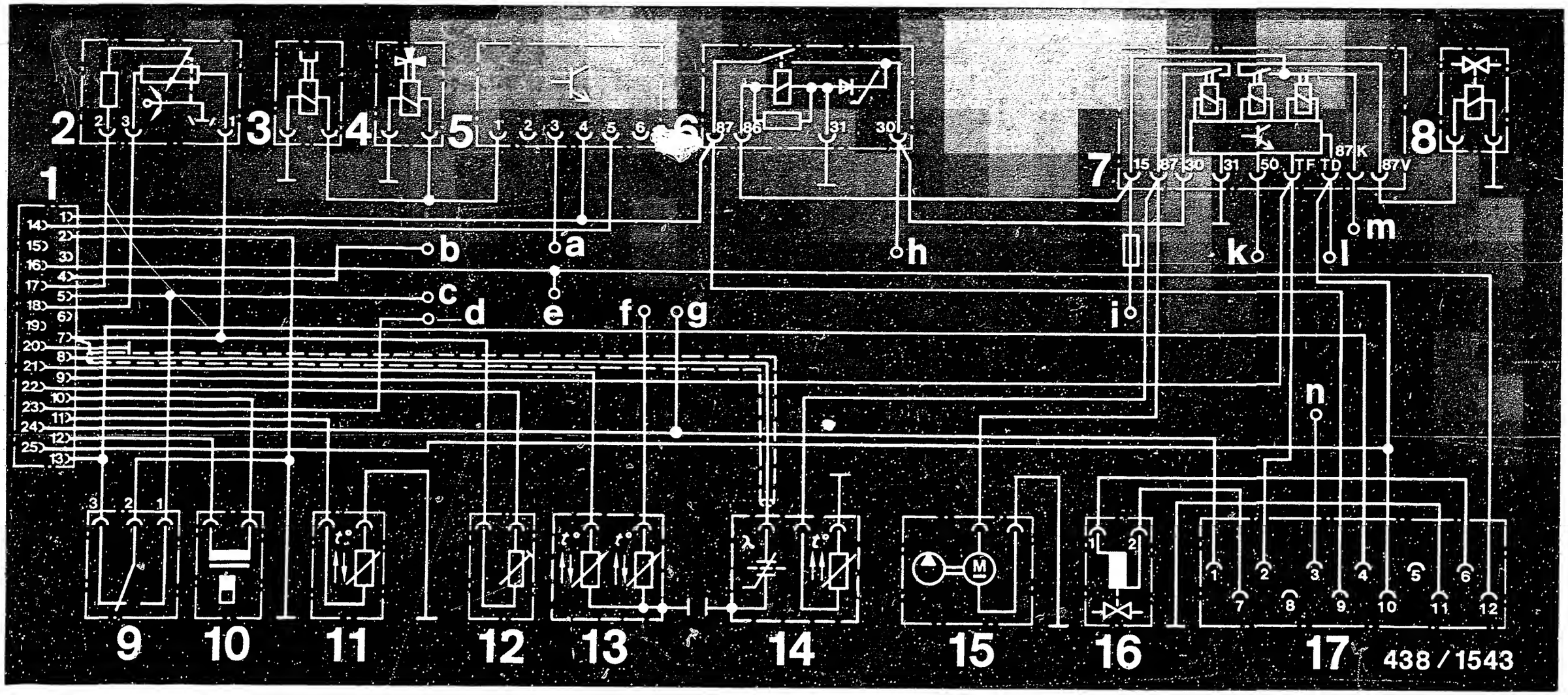
No.	Switch/Btn V	Ω	Btn	Under test	Test pins	Test conditions	Test specifications
22	–	–	–	Overrun cut-off	12–12	Re-connect ohmmeter (swap positive and negative). Start engine (normal op. temp.). Drive vehicle on vehicle-performance tester or road. Speed > 40 km/h. Engine speed ≥ 2500 min $^{-1}$. Vehicle in overrun. (Idle throttle-valve switch closed) Current reading:	 –40...–80 mA
23	–	21	–	Full-load enrichment	12–12	Engine at normal operating temperature, idle. Current value: Briefly push accelerator pedal to floor (full-load throttle-valve switch must switch). During speed rise, current value rises by: A t t e n t i o n: Do this very briefly, so that speed does not rise too much and engine is not damaged.	 –>FD ——— : ——— mA FD 549–>: –1...+1 mA –>FD ——— : ——— mA FD 549–>: 3...6 mA

FD = Date of manufacture

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (CONTINUED)

No.	Switch/Btn V	Ω	Btn	Under test	Test pins	Test conditions	Test specifications CAT
24	–	24	–	Lambda closed-loop control, closed-loop control operation	12–12	Disconnect regeneration lead to venturi assembly at regeneration valve and seal off. Engine at normal operating temperature, idle. Closed-loop control operation can be recognised from the oscillating current reading. Mean value: If mean value outside tolerance, set (idle-mixture-adjusting screw) to approx.:	 –2...+2 mA 0 mA
25	–	22	–	Lambda closed-loop control, rich stop	12–12	Engine at normal operating temperature, idle. Current rise to:	10...14 mA
26	–	23	–	Lambda closed-loop control, lean stop	12–12	Engine at normal operating temperature, idle. Current drop to:	–8...–12 mA

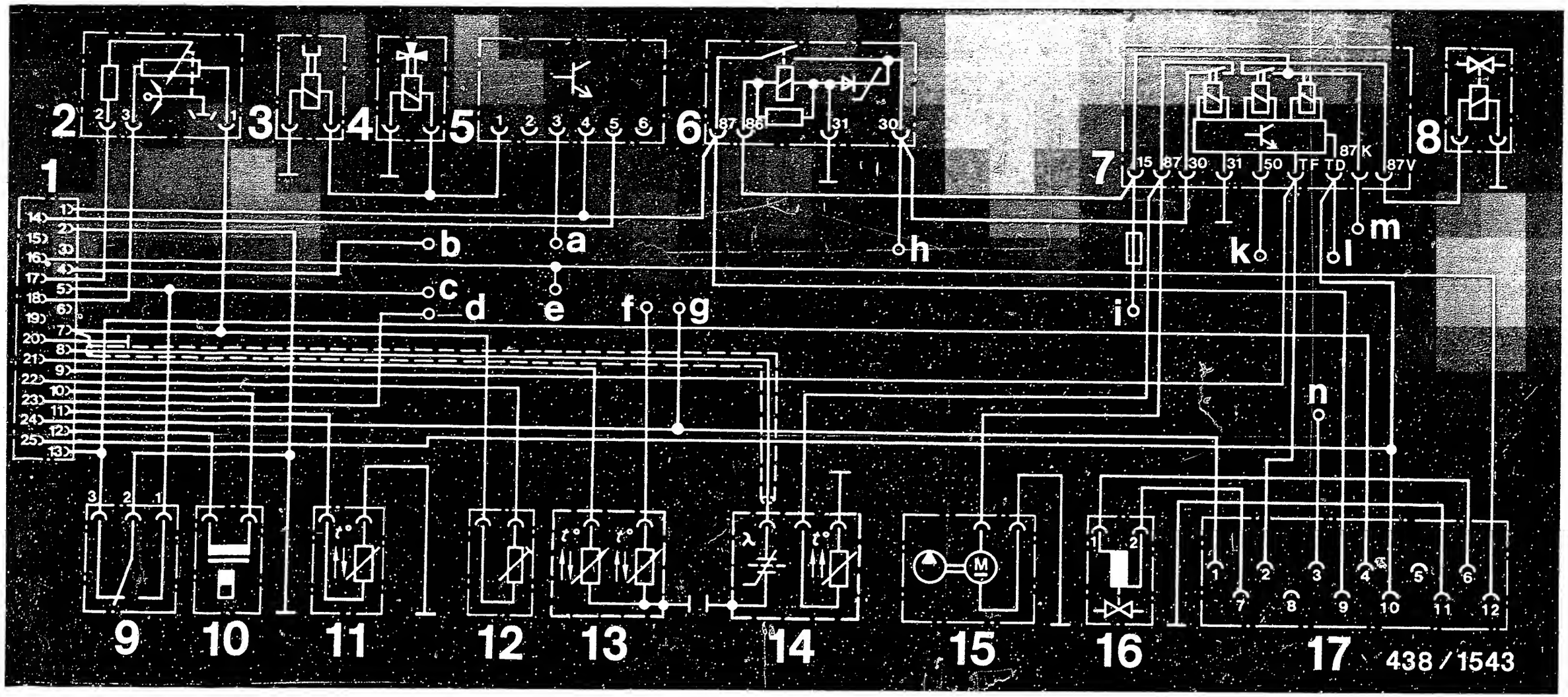
FD = Date of manufacture



1 = Control unit, KE-Jetronic
2 = Air-flow sensor potentiometer
3 = Electro-magnetic coupling, air pump (CAT only)
4 = Change-over valve, air pump (CAT only)
5 = Relay, air injection (CAT only)
6 = Overvoltage-protection relay
7 = Electronic relay
8 = Cold-start valve
9 = Throttle-valve switch, idle/full load
10 = Electro-hydraulic pressure actuator
11 = Temperature sensor, intake air
12 = Trimming plug, mixture map
13 = Temperature sensor, engine (double NTC)
14 = Heated lambda sensor
15 = Electric fuel pump
(2 pumps are installed connected in parallel)
16 = Idle actuator (non-Bosch product)
17 = Control unit, low-idle-speed control
(non-Bosch product)

ELECTRICAL TERMINAL DIAGRAM WITH ELECTRIC FUEL PUMP SAFETY CIRCUIT

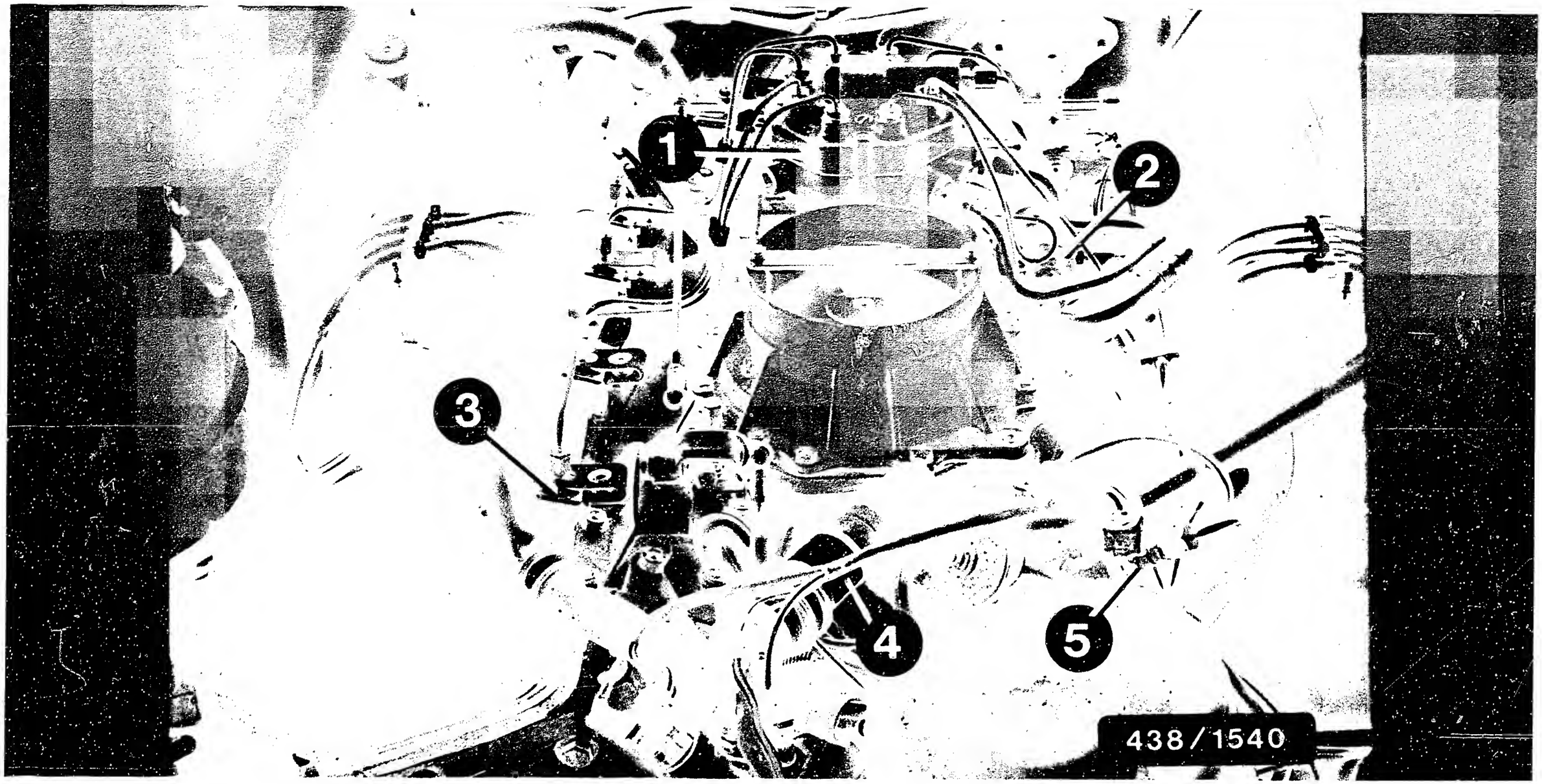
M19 ——— ==> M20 ——— <==>



a = Terminal 15
b = Plug connection, trip computer
c = Trigger box, ignition system
d = Lambda test output (diagnosis socket outlet, socket 3)
e = Plug connection, start-locking switch, socket 3
f = Trigger box, ignition system
g = Speed signal

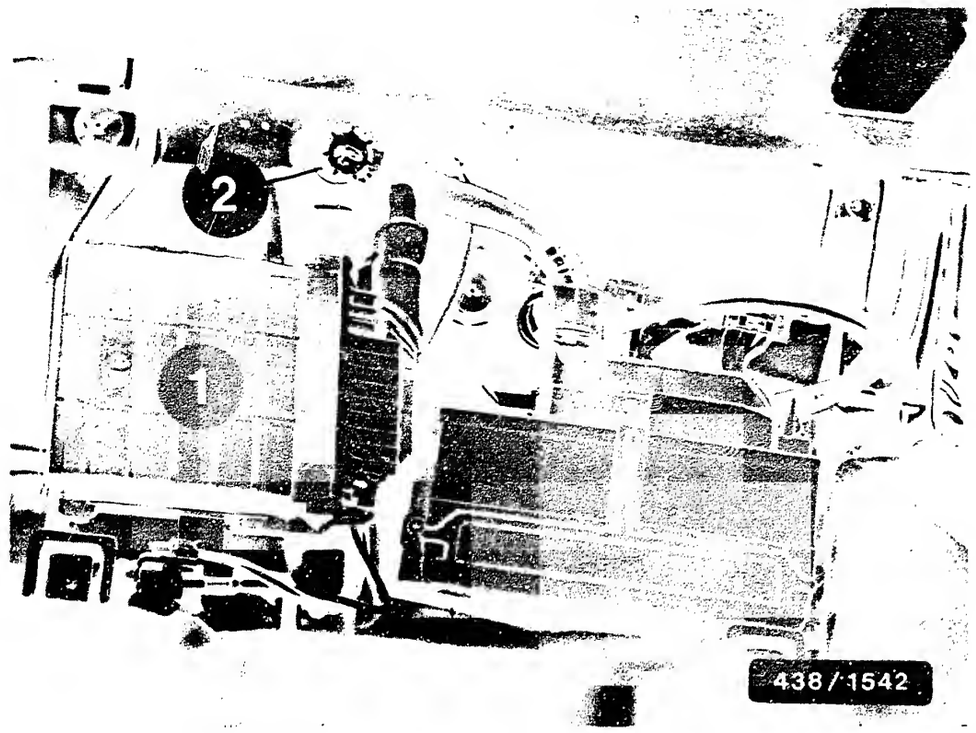
h = Terminal 30
i = Terminal 15 (fuse 7)
k = Plug connection, start-locking switch, socket 4
l = Terminal TD, ignition
m = Kick-down switch, socket 1
n = Control unit, compressor cutoff

Electrical terminal diagram with electric fuel pump safety circuit (continued)



1 = Mixture-control unit
2 = Pressure regulator
3 = Injection valve
4 = Idle actuator (non-Bosch product)
5 = Cold-start valve

INSTALLATION POSITION OF COMPONENTS



1 = KE-Jetronic control unit (Type 107)
2 = Mixture-map trimming plug

In the Type 107, the KE-Jetronic control unit and mixture-map trimming plug are positioned in the footwell on the right beneath the floor panel;
in the Type 126, in the footwell on the right behind the side panel.

Installation position of further components

Relay, electric fuel pump:
In the Type 126, in the eng. comp, on left
in the Type 107, behind the glove comp.

Relay, over-voltage protection:
In the Type 126, in the eng. comp. on left
in the Type 107, in the footwell on right behind the side panel.

Temperature sensor, engine (NTC II):
At the left (referring to forward direction of travel) at cyl. head at rear.